XS SERIES

version : 0.44

XS SERIES MANUAL

ELECTRICAL SAFETY TESTERS

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This manual is written for the following XS series models:

	Hipot50VA 5kVAC	Hipot500VA 5kVAC	Hipot20VA 6kVDC	Hipot200VA 6kVDC	Insulation 500V/200GΩ	Ground 30A/1500mΩ	Sequence
RXS50	x						
RXS56	x		x				
RXS500		x					
RXS506		x		x			
DXS50	x				x		
DXS56	x		x		x		
DXS500		x			x		
DXS506		x		x	x		
SXS50	x				x	x	x
SXS56	x		x		x	x	x
SXS500		x			x	x	x
SXS506		x		x	x	x	x

According to your unit model, please refer to the corresponding section in the following pages.

WARRANTY

SEFELEC warrants that units are free from defects in material and workmanship. SEFELEC warrants also that, when properly used, that units will perform in accordance with specifications of this manual.

If within one year after original delivery it is found not to meet this standard, it will be repaired at no charge in SEFELEC service facility in Lognes.

Changes in the unit not approved by SEFELEC will cancel this warranty.

SEFELEC will not be liable for any indirect damages resulting of the use of the unit.

This warranty is in lieu of all other warranties.

RESTRICTIONS DUE TO THE ACCESSORIES OR TO THE OPTIONS

Ground continuity measurement

- CO184/3 to CO184/10 : Maximum current regulation 10A for 6V, 20A for 12V.
- CO183/3 to CO183/10 : Maximum current regulation 10A for 6V, 20A for 12V.
- TE66/3 to TE66/10 : Maximum current regulation 10A for 6V, 20A for 12V.
- TE80/3 to TE80/10 : Maximum current regulation 10A for 6V, 20A for 12V.
- TE81/3 to TE81/10 : Maximum current regulation 10A for 6V, 20A for 12V.
- CS1 : Maximum current regulation 10A for 6V, 20A for 12V.

Hipot test

- CO193 CO174, CO185,CO192 : **4000VAC** limited max. voltage.
- CO200 to CO209 : **4000VAC** limited max. voltage.
- FMG501 : **4200VAC** limited max. voltage.

Insulation measurement

- CO 210 : Measurement limited to 2GΩ
- FMG501 rack and Option MG-55 or MG-57(three phase) : Measurement limited to 2GΩ.

Summary

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Specifications

Power supply

- Mains :
  - 115/230V~ ±15% single phase 47 to 64 Hz (DXS50/56, RXS50/56, SXS50/56).
  - 230V~ ±15% single phase 47 to 64 Hz (DXS500/506, RXS500/506, SXS500/506).

- Temporized protective fuse in mains socket on the rear panel :

  - RXS50/56, DXS50/56, SXS50/56 : 2AT for 230V and 4AT for 115V.
  - RXS500/506, DXS500/506, SXS500/506 : 4AT for 230V.

Power consumption: 40VA without load, 550 VA maximum.

Operating condition

- The instrument must be used indoor, in horizontal position or on tripode
- Operating temperature :
  - Storage : -10°C to +60°C.
  - Operation : 0°C to +45°C.
- Accuracy is rated after half an hour of warm up and for a relative humidity < 50%.
- Altitude : up to 2000 meters
- Max. Humidity rate: 80% for a temperature of 31°C.

Weight and dimensions

	RXS50/56 - DXS50/56	RXS500/506 -RXS500/506	**SXS50/56***	**SXS500/506***
weight	15kg	21kg	27kg	28kg
height width depth	131 mm ± 0.5 440.5 mm ± 0.5 450.5 mm. ± 0.5			

* **Note: the weight of those units being over 25kg, 2 persons are necessary for manipulations.**

Over voltage category

CAT II.

Pollution rate

Pollution 2 : Occasional conductive pollution only by condensation.

Safety class

Class I instrument : Earth protection by mains connection.

1- DIELECTRIC STRENGTH TEST 50VA (hipot 50VA test)

Output voltage

- Alternative 50 or 60Hz (DC voltage on XS56 model).
- From 100V to 5 kVAC in one range (100V to 6 KVDC).
- Stability < ±1% for ΔV mains of ±10%.
- Positive pole to earth with DC voltage
- Residual < 1% for Is=100 µA with DC voltage
- Accuracy of the output voltage: ±(2%+50volts) in relation with the set value for voltages between 100 and 5000 volts (6000 volts for DC) and for a current < 100 µA in the fault detection modes : ΔI, IMAX or ΔI+IMAX.
- Discharge of the tested specimen and of the internal capacitor through a 1.5 MΩ resistance with DC voltage

Voltage reading

- By kilovoltmeter directly connected to the output terminals.
- Accuracy : ±(1.5%+20 volts) of the read value.
- Display by 600 points digital indicator.

Short circuit current

- <15 mA in AC for the maximum voltage adjustment.
- <15 mA in DC for the maximum voltage adjustment.

Breakdown detection

Current variation mode: ΔI

The ΔTEST detector automatically carries out the subtraction between the current which flows normally in the device under test (I=U/Z) and the one which occurs at the time of a fault (I'=I+Ifault).

- Amplitude adjustable between : 1 mA and 10mA ±10% by 1 mA step.
- Width of current pulse : 10µS ±20%

Maximum current limit : IMAX

Adjustable from 0.01 mA to 9.99 mA by 0.01mA step.

The unit monitors permanently the current flowing through the sample under test and compares according the 2 following possibilities:

- The high limit (IMAX) > 0 , the low limit (IMIN) is set to 0
  - If the measured current is > or = to the IMAX, then the test is FAIL (breakdown)

- The high limit (IMAX) > 0 , the low limit (IMIN) is set to a value < IMAX
  - If the measured current is < IMAX and > IMIN then the test is PASS, otherwise the test is FAIL (breakdown or I < IMIN)

WARNING :
This detection mode can require between 200 and 300 msec. for the limit detection, and during this time the current can increase quickly over the limit .

Fast maximum current limit : F(ast)IMAX

Specifications are identical to the IMAX detection mode .
However in the FIMAX mode the breakdown detection is fastest (20 msec.) than in IMAX mode because the comparison with the current limit is performed directly by electronic circuits and not by the embedded software. The comparison accuracy is lower than the IMAX mode.

Fast maximum current and variation current limit : FIMAX + ΔI

This mode combines the FIMAX mode and the Delta I mode.

Maximum current and variation current limit : IMAX + ΔI

This mode combines the IMAX mode and the Delta I mode.

Minimum current limit : IMIN

In the above detection modes it is possible to set a minimum value of current flowing through the specimen under test : IMIN value adjustable from 0.00 mA up to 9.99 mA to insure that the specimen under test is correctly connected.

Without detection

In this mode there is no current monitoring.

There is no output high voltage adjustment according to the load.

WARNING,
Permanent operation on heavy loads in this mode can heat the electronic amplifier. The internal fan will start automatically to reduce the temperature, with a possible stop of the HV generator for safety reasons.

Permanent current measurement

- Direct reading of the current on a shunt resistance in the test circuit.
- Display of the value on a 999 points digital indicator.
- Accuracy : ±(2.5% + 2 U) of the read value (1U=0.01mA).

In VDC accuracy is given for resistance loads > 1 MΩ.

Fault indication

- By message on the LCD display, red and green LED, and audible signal (possibility to inhibit).
- Memory storage of the breakdown voltage.
- Memory storage of the leakage current in IMAX mode.
- Cut off of the high voltage at the first zero crossing of the control sinusoidal signal of the HV transformer, thus without over voltage.

Timer

(mode) MANUAL

The timer is not used during the test . The voltage output is manually controlled by pressing on the UP/DOWN arrows. The test stops when a breakdown occurs or when pressing on the red push button on the front panel.

(mode) DEFAULT

The timer is not used during the test . The voltage output is defined in the parameter VOLTAGE line. The test stops when a breakdown occurs or when pressing on the red push button on the front panel.

(mode) AUTO

The test is defined by three consecutive times during which the output voltage rises linearly up to the preset value (RISE time) , then is hold to the preset value (HOLD time) and finally bring back to zero (FALL time).
The RISE and FALL times can be set from 0 to 1 sec. by 0.1 sec. step and from 1 to 999 sec. by 1 sec. step.
The HOLD time can be set from 1 to 999sec. by 1 sec. step.

2 - DIELECTRIC STRENGTH TEST 500VA (hipot 500VA test)

Output voltage

- Alternative 50 or 60Hz (DC voltage on XS506 model).
- From 100V to 5 kVAC in one range (100V to 6 KVDC).
- Stability < ±3% for ΔV mains of ±10%.
- Positive pole to earth with DC voltage
- Residual < 1% for Is=100 µA with DC voltage
- Accuracy of the output voltage : ±(3%+50volts) in relation with the set value for voltages between 100 and 5000 volts (6000 volts for DC) and for a current < 1mA in the fault detection modes : ΔI, IMAX or ΔI+IMAX.
- Discharge of the tested specimen and of the internal capacitor through a 1.5 MΩ resistance with DC voltage

Voltage reading

- By kilovoltmeter directly connected to the output terminals.
- Accuracy : ±(1.5%+20 volts) of the read value.
- Display by 600 points digital indicator.

Short circuit current

- > 200 mA in AC for the maximum voltage adjustment.
- > 100 mA in DC for the maximum voltage adjustment.

Breakdown detection

Current variation mode : ΔI

The ΔTEST detector automatically carries out the subtraction between the current which flows normally in the device under test (I=U/Z) and the one which occurs at the time of a fault (I'=I+Ifault).

- Amplitude adjustable between : 10 mA and 100mA ±10% by 10 mA step.
- Width of current pulse : 10µS ±20%

Maximum current limit : IMAX

Adjustable from 0.1 mA to 110 mA by 0.1mA step.

The unit monitors permanently the current flowing through the sample under test and compares according the 2 following possibilities :

- The high limit (IMAX) > 0 , the low limit (IMIN) is set to 0
  - If the measured current is > or = to the IMAX, then the test is FAIL (breakdown)

- The high limit (IMAX) > 0 , the low limit (IMIN) is set to a value < IMAX
  - If the measured current is < IMAX and > IMIN then the test is PASS, otherwise the test is FAIL (breakdown or I < IMIN)

WARNING :
This detection mode can require between 200 and 300 msec. for the limit detection, and during this time the current can increase quickly over the limit .

Fast maximum current limit : F(ast)IMAX

Specifications are identical to the IMAX detection mode .
However in the FIMAX mode the breakdown detection is fastest (20 msec.) than in IMAX mode because the comparison with the current limit is performed directly by electronic circuits and not by the embedded software. The comparison accuracy is lower than the IMAX mode.

Fast maximum current and variation current limit : FIMAX + ΔI

This mode combines the FIMAX mode and the Delta I mode.

Maximum current and variation current limit : IMAX + ΔI

This mode combines the IMAX mode and the Delta I mode.

Minimum current limit : IMIN

In the above detection modes it is possible to set a minimum value of current flowing through the specimen under test : IMIN value adjustable from 0.00 mA up to 9.99 mA to insure that the specimen under test is correctly connected.

Without detection

In this mode there is no current monitoring.

There is no output high voltage adjustement according to the load.

WARNING,
Permanent operation on heavy loads in this mode can heat the electronic amplifier. The internal fan will start automaticaly to reduce the temperature, with a possible stop of the HV generator for safety reasons.

Permanent current measurement

- Direct reading of the current on a shunt resistance in the test circuit.
- Display of the value on a 999 points digital indicator.
- Accuracy : ±(2.5% + 2 U) of the read value (1U=0.1mA).

In VDC accuracy is given for resistance loads > 1 MΩ.

- Display of « STRONG CURRENT » message as well as « ---MA » when the current is over 110mA (AC current) and 20mA in DC
- The current indicated on the display in DC is the rms current. That is to say

Iaff = $\sqrt{I_{ac}^2 + I_{dc}^2}$

Fault indication

- By message on the LCD display, red and green LED, and audible signal (possibility to inhibit).
- Memory storage of the breakdown voltage.
- Memory storage of the leakage current in IMAX mode.
- Cut off of the high voltage at the first zero crossing of the control sinusoidal signal of the HV transformer, thus without over voltage.

Timer

(mode) MANUAL

The timer is not used during the test . The voltage output is manually controlled by pressing on the UP/DOWN arrows. The test stops when a breakdown occurs or when pressing on the red push button on the front panel.

(mode) DEFAULT

The timer is not used during the test . The voltage output is defined in the parameter VOLTAGE line. The test stops when a breakdown occurs or when pressing on the red push button on the front panel.

(mode) AUTO

The test is defined by three consecutive times during which the output voltage rises linearly up to the preset value (RISE time) , then is hold to the preset value (HOLD time) and finally bring back to zero (FALL time).
The RISE and FALL times can be set from 0 to 1 sec. by 0.1 sec. step and from 1 to 999 sec. by 1 sec. step.
The HOLD time can be set from 1 to 999sec. by 1 sec. step.

3 Megohmmeter function (insulation resistance measurement)

500V megohmmeter function

Measurement voltage

Voltage adjustable from 10V to 500VDC by 1 volt step.
Accuracy : ±(1% + 1V).

Positive pole of the HV generator is grounded (earth)
Dynamic stability for a mains ΔV = ±10% : >1%.
The maximum current in the measurement circuit is : 2 mA ±20%.
The discharge current is limited by a 2.2 kΩ resistor.

Measurement range

Display : 2000 digits
The measurement range is defined by the following formula :

(Utest / Umax generator) x 200 GΩ *

* or 2TΩ according to the option

This gives the following board for the 50,100, 250, 500VDC standard voltages

200GΩ basic version	
Voltage	Measurement range
50V	50kΩ to 20GΩ
100V	100kΩ to 40GΩ
250V	250kΩ to 100GΩ
500V	500kΩ to 200GΩ

2TΩ option version	
Voltage	Measurement range
50V	50kΩ to 200GΩ
100V	100kΩ to 400GΩ
250V	250kΩ to 1TΩ
500V	500kΩ to 2TΩ

Measurement accuracy

2000 digits numeric display with unity indication (KΩ, MΩ, GΩ,TΩ).
Accuracy (% of the reading, 1U = 1 digit) :

	DXS and SXS models
200 GΩ basic version	±(1.5% + 1U)
2 TΩ option and U<=200VDC	±(2% + 1U)
2 TΩ option and U > 200VDC	±(1% x Utest / 100 + 1U)

CAPACITANCE mode : from 1.00MΩ to 200GΩ (or 2 TΩ for option 20) with an accuracy equal to the NORMAL mode accuracy ±100kΩ
Input impedance = 10 MΩ ±1%

Measurement threshold

The megohmmeter function can operate either with one or two measurement threshold(s) between 50kΩ up to 200GΩ (2TΩ with option 20).
A measurement is PASS after comparison between the displayed value and the thresholds.
When looking for a value only higher than a limit, the LOW THRESHOLD is used to set the limit and the HIGH THRESHOLD is not used by setting a value equal to the maximum resistance (basically 200GΩ).
When looking for an insulation resistance higher than a limit but not too much high (which can means that the specimen is not correctly connected), then the LOW THRESHOLD is set the minimum insulation value expected and the HIGH THRESHOLD is set to the maximum insulation value expected.

Setting examples:

LOW THRESHOLD	MEASURED value	HIGH THRESHOLD	Result
10 MΩ	15.4 MΩ	200 GΩ*	PASS (insulation > LOW limit)
10 MΩ	9.0 MΩ	100 MΩ	FAIL (insulation < LOW limit)
55 MΩ	63.2 MΩ	80 MΩ	PASS (insulation > LOW limit + < HIGH limit)
45 MΩ	110 GΩ	75 MΩ	FAIL (insulation > HIGH limit)

* threshold not active

Timer

The measurement voltage can stay permanently (timer value set to 0 sec.) or during a time between 1 and 999 sec. adjustable by 1 sec. step.
Rise and fall times are adjustable in time (second) or in voltage increase (dv/dt) from 0.1 to 0.9 sec. and from 1 to 999 sec. or in V/s from 1V/s to 500V/s.

1000V megohmmeter function (option XS26)

Measurement voltage

Voltage adjustable from 20V to 1000VDC by 1 volt step.
Accuracy : ±(1% + 1V).

Positive pole of the HV generator is grounded (earth)
Dynamic stability for a mains ΔV = ±10% : >1%.
The maximum current in the measurement circuit is : 2 mA ±20%.
The discharge current is limited by a 2.2 kΩ resistor.

Measurement range

Display : 2000 digits
The measurement range is defined by the following formula :

(Utest / Umax generator) x 200 GΩ *

* or 2TΩ according to the option

This gives the following board for the 100, 250, 500, 1000VDC standard voltages

200GΩ basic version	
Voltage	Measurement range
100V	100kΩ to 20GΩ
250V	250kΩ to 50GΩ
500V	500kΩ to 100GΩ
1000V	1MΩ to 200GΩ

2TΩ option version	
Voltage	Measurement range
100V	100kΩ to 200GΩ
250V	250kΩ to 500GΩ
500V	500kΩ to 1TΩ
1000V	1MΩ to 2TΩ

Measurement accuracy

2000 digits numeric display with unity indication (KΩ, MΩ, GΩ,TΩ).
Accuracy (% of the reading, 1U = 1 digit) :

	DXS and SXS models
200 GΩ basic version	±(1.5% + 1U)
2 TΩ option and U<=200VDC	±(2% + 1U)
2 TΩ option and U > 200VDC	±(1% x Utest / 100 + 1U)

CAPACITANCE mode : from 1.00MΩ to 200GΩ (or 2 TΩ for option 20) with an accuracy equal to the NORMAL mode accuracy ±100kΩ
Input impedance = 10 MΩ ±1%

Measurement threshold

The megohmmeter function can operate either with one or two measurement threshold(s) between 50kΩ up to 200GΩ (2TΩ with option 20).
A measurement is PASS after comparison between the displayed value and the thresholds.
When looking for a value only higher than a limit, the LOW THRESHOLD is used to set the limit and the HIGH THRESHOLD is not used by setting a value equal to the maximum resistance (basically 200GΩ).
When looking for an insulation resistance higher than a limit but not too much high (which can means that the specimen is not correctly connected), then the LOW THRESHOLD is set the minimum insulation value expected and the HIGH THRESHOLD is set to the maximum insulation value expected.

Setting examples:

LOW THRESHOLD	MEASURED value	HIGH THRESHOLD	Result
10 MΩ	15.4 MΩ	200 GΩ*	PASS (insulation > LOW limit)
10 MΩ	9.0 MΩ	100 MΩ	FAIL (insulation < LOW limit)
55 MΩ	63.2 MΩ	80 MΩ	PASS (insulation > LOW limit + < HIGH limit)
45 MΩ	110 GΩ	75 MΩ	FAIL (insulation > HIGH limit)

* threshold not active

Timer

The measurement voltage can stay permanently (timer value set to 0 sec.) or during a time between 1 and 999 sec. adjustable by 1 sec. step.
Rise and fall times are adjustable in time (second) or in voltage increase (dv/dt) from 0.1 to 0.9sec. and from 1 to 999 sec. or in V/s from 1V/s to 1000V/s.

4 Ground continuity function

Measurement current

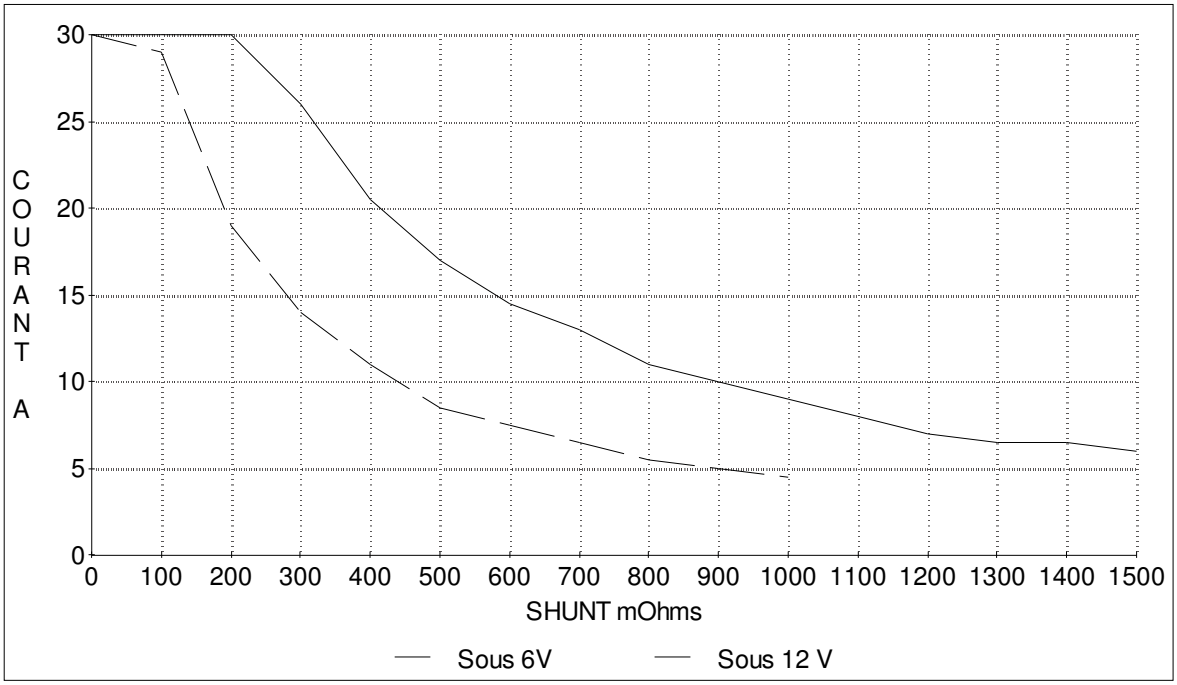
- From 5 to 30A AC by step of 0.5 A AC.
- Frequency = mains frequency
- Accuracy : ±(1% + 500mA).

Open circuit voltage

- < 6 VAC or < 12 VAC.
- Sinus wave.
- Frequency identical to the mains.

Measurement accuracy

- Display on 1500 points digital indicator with unity indications (mΩ).
- Accuracy (in % of the reading. 1U = 1 display count 1mΩ) : ±(2.5%+10U) in the following measurement range :



Measurement thresholds

The ground continuity function can operate either with one or two measurement threshold(s) between 1mΩ to 1500mΩ.
A measurement is PASS after comparison between the displayed value and the thresholds.
When looking for a value only lower than a limit, the HIGH THRESHOLD is used to set the limit and the LOW THRESHOLD is not used by setting a value equal to the minimum resistance (basically 0mΩ).
When looking for a ground continuity resistance lower than a limit but not too much low (which can means that the specimen is not correctly connected), then the LOW THRESHOLD is set the minimum continuity value expected and the HIGH THRESHOLD is set to the maximum continuity value expected.

Setting examples:

LOW limit	Measure	HIGH limit	Test result
0 mΩ	98.0 mΩ	100 mΩ	PASS (continuity < High limit)
0 mΩ	120 mΩ	100 mΩ	FAIL (continuity > High limit)
55 mΩ	63.2 mΩ	80 mΩ	PASS (continuity > Low limit and < High limit)
45 mΩ	10 mΩ	75 mΩ	FAIL (continuity < Low limit)

* threshold not active

Timer

The measurement voltage can stay permanently (timer value set to 0 sec.) or during a time between 1 and 999 sec. adjustable by 1 sec. step.
Rise and fall times are adjustable in time (second) or in voltage increase (dv/dt) from 0.1 to 0.9 sec. and from 1 to 999 sec. or in V/s from 1V/s to 1000V/s.

Measurement cycles

If the current generated is high (≥ 25A), it can lead to a current overheating of the transformer and start up its protection (See Section 5.3).
The hereunder board indicates the maximum operating time of the ground continuity resistance measurement according to the use cycle (1 ½ cycle represents use of the current during one second for a total duration of the cycle of 2 seconds)
Note : All these duration concern a 30A current. For lower currents, this duration is higher.

Cycle	1/1	1/2	1/3
Operation time	25 minutes	5 hours	Permanent

5 INTRODUCTION - OPERATING INSTRUCTION

WARNING : This unit must be used by qualified people. Every precautions for the use of units connected to the mains must be taken during its use. In particular, this unit must be connected to earth.
The specifications of this manual, the correct operation of the unit as well as the operator's security are guaranteed only when the supplied accessories are used. The measurement probes can include limitation or protective elements, therefore it is forbidden to modify without written agreement from SEFELEC Company.
In case of use under other conditions than the one specified in this manual, the security of the user will be in danger.

Except for the ground continuity function, this unit can supply voltages and currents which could be lethal. Comply with the safety regulations related to the use of high voltage devices.

ALWAYS MAKE SURE THE HIGH VOLTAGE INDICATOR IS NOT ON WHEN CONNECTING OR DISCONNECTING THE SPECIMENS

MEANING OF THE DIFFERENT SYMBOLS ON THE INSTRUMENT

	Warning (See document attached)		WEEE recycling
	Warning, risk of electric chock.		
	DC voltage.		
	AC and DC voltages.		
	AC voltage.		
	Earth connection.		
	Do not connect to earth		

PRODUCT OVERVIEW

The XS series is a range of units performing very easily insulation resistance measurements, dielectric strength tests and ground continuity tests.

The RXS50/56 and RXS500/506 are dielectric strength testers under 50VA or 500VA and the DXS50/56 and DXS500/506 are dielectric strength testers under 50VA or 500VA including a megohmmeter, and the SXS50/56 and SXS500/506 include all the above functions plus a ground continuity function.

The XS series makes possible to perform insulation resistance measurement, ground continuity resistance measurement and dielectric strength test on a various number of insulating material as resin, porcelain, oil, plastic as well as on final products such as capacitors, transformers, switches, cables, connectors or on devices connected to the main or supplied by batteries. The instruments allow ground continuity measurement fitting most part of the existing standards regarding measuring and medical fields, office devices, machinery,...

The XS series is fitted with a high resolution liquid crystal display (LCD) and a keyboard allowing an easy use. A single output for the dielectric strength tests and the insulation resistance measurements makes easy the connection on the specimens. Red and green LED lamps indicate visually and without any confusion the tests results.

The dielectric strength tests are performed under adjustable voltages from 100 VAC up to 5000 VAC (up to 6000 VDC for the XS56 and XS506 models) with a short circuit current of 10 mA for 50VA models and 200 mA for 500VA models. The breakdown voltages and currents are memorized on the display after breakdown detection and voltage cut off.

The insulation resistance measurements are performed under voltages from 10 up to 500VDC (20 to 1000VDC with option 26). The XS unit indicates in a direct reading with unity display, the resistance values from 50 kΩ up to 200 GΩ (2 TΩ in option).

The ground continuity resistance measurement is performed under current from 5 to 30A AC with open circuit voltages of 6 or 12V AC. The XS unit indicates in a direct reading with unity display, the resistance values from 1mΩ to 1500mΩ.

RS232C serial interface comes as standard with the XS series and in option, the unit can be equipped with PLC input/output interface or with a IEEE488 or ETHERNET interface enabling a full remote control by a PC computer.

Front panel description

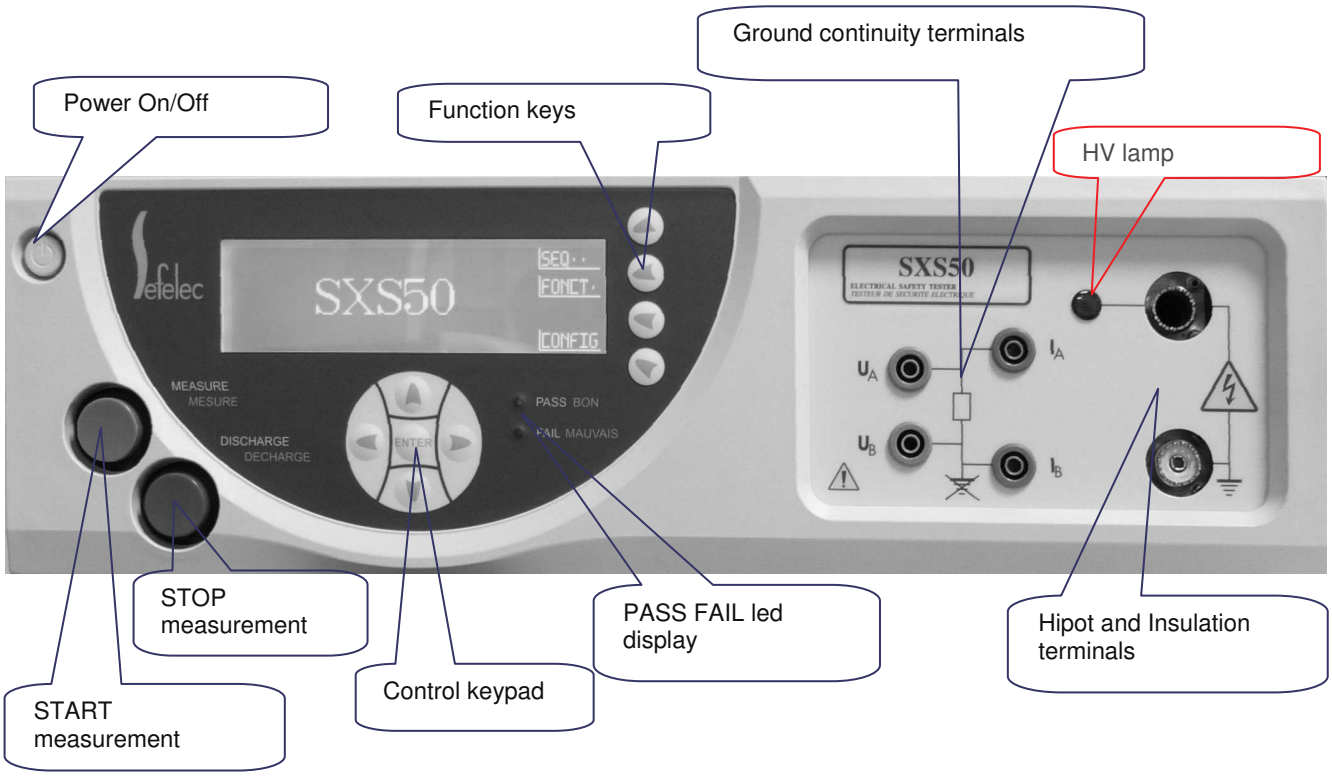


fig 5.1

Keys definition

The front panel unit includes 2 mechanical push buttons (1 red and 1 green) together with 9 keys in 3 function areas. Any action on a key or a push-button is confirmed by an audible signal.
The green push-button starts the test or measurement cycle and the red push-button stops the cycle at any time.
The function keys on the right hand side of the LCD screen select the measurement functions, the configuration as well as the memories and the parameter access.
The meaning of the function key is displayed on the LCD screen right hand side. When nothing is displayed, the function key is not operating.

The control keypad includes 4 direction keys and one central ENTER key.
The UP and DOWN keys increase or decrease the parameter values and the LEFT and RIGHT keys move the cursor on the position to be modified.
The CENTRAL key enters the new parameter value.

Liquid Crystal Display (LCD) description

The unit is fitted with a liquid crystal display (LCD) of 64 points per 240 points used in a graphic mode.

According to the position of the user related to the unit screen and the light conditions, it is possible to adjust the screen contrast by turning the potentiometer located on the rear panel (Z9). The screen is LED back lighted, this allowing the use of the unit even the light conditions are poor.

The screen is divided in 5 areas arranged as follows:

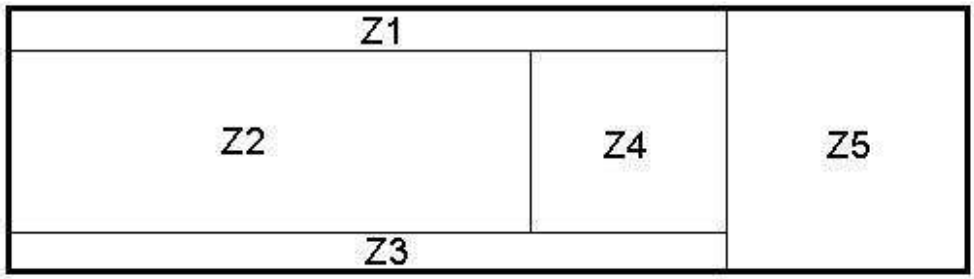


fig 5.2

- Z1 Help messages (in normal video mode) or error messages (in reverse video mode)
- Z2 Display of the measurement results with big characters (18 mm x 12 mm). In the input parameters mode, display of test parameters for possible changes.
- Z3 Recall of the measurement parameters.
- Z4 Symbol recalling the selected test (MΩ KΩ, mΩ...).
- Z5 Indicates the name of the function keys on the right side of the LCD display.

Rear panel description

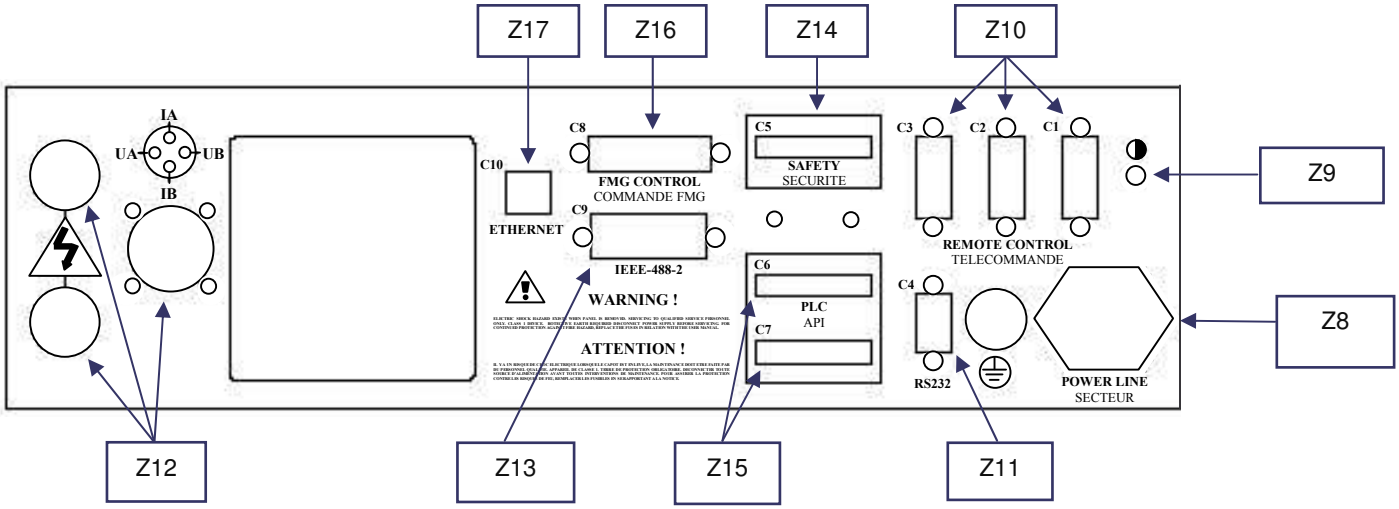


fig 5.3

The rear panel includes the following areas :

- Z8 Mains power input connector with voltage selector (115V/230V).
- Z9 LCD contrast adjustment potentiometer.
- Z10 15 points female sub-D connector for remote trigger accessory connection .
- Z11 9 points female sub-D connector for RS232C interface.
- Z12 Area for the output of the cables in the REAR PANEL OUTPUT option.
- Z13 24 points connector for IEEE-488-2 interface.
- Z14 10 points screw terminal for safety loop connection.
- Z15 10 points screw terminal for PLC connection.
- Z16 25 points female sub-D connector for Leakage current measurement function.
- Z17 RJ45 connector for ETHERNET interface.

Supplied accessories

- 1 operating manual (CD)
- 1 power cord (SE1)
- 3 x 10 pts screw terminal with pre-wired safety loop.
- 1 return cord CO175

Available accessories and options

- TE54 hand held HV probe 50VA (DXS50, RXS50, SXS50)
- TE58-XS hand held HV probe with remote control 50VA (DXS50, RXS50, SXS50)
- TE65 hand held HV probe 500VA (DXS500, RXS500, SXS500)
- TE66 groung continuity measurement set with CO183 and CO184 (SXS50, SXS500)
- TE81-XS ground continuity probe with remote control and PASS/FAIL indication for multiple continuity feature.
- TE83-XS HV 500VA test pistol with remote control .
- TE86-XS HV 50VA test pistol with remote control.
- CO160-XS red/green lamp to indicate when HV is on
- CO174 external box equipped with a female european mains socket 50VA (DXS50, RXS50, SXS50)
- CO175 return of measurement lead (DXS50, RXS50, SXS50, SXS500)
- CO177 HV measurement lead for automatic test systems connection (only for 50VA)
- CO179 RS232C interface cable.
- CO180 HV measurement lead for automatic test systems connection (only for 500VA)
- CO183 2 wires cable for continuity measurement with crocodile clip (SXS50, SXS500)
- CO184 2 wires cable for continuity measurement with retractable tip probe (SXS50, SXS500)
- CO185 external box equipped with female French socket 500VA (DXS500, RXS500, SXS500)
- CO192 external box equipped with 6 x female different country socket 50VA (DXS50, RXS50, SXS50).
- CO193 external box equipped with 6 x female different country socket 500VA (DXS500, RXS500, SXS500).
- CO200 à CO209 : external box equipped with female foreign socket 50 or 500VA.
- CO210 return pistol.
- AO10-XS remote control operating with 2 hands
- AO11-XS remote control footswitch.
- KRXS rack mounting kit
- OPTION XS-02 PLC (programmable logic controler) interface
- OPTION XS-03 0-10 volts analog input/output (DXS50, RXS50)
- OPTION XS-04 test sequence (DXS50, DXS500)
- OPTION XS-05 measurement input/output on the rear panel
- OPTION XS-06 IEEE 488 interface
- OPTION XS-07 3mA AC/DC current limitation
- OPTION XS-08 PLC interface + 0-10 volts analog input/output
- OPTION XS-10 6000VDC 20VA (DXS50, RXS50, SXS50)
- OPTION XS-13 6000VDC 200VA (RXS500, DXS500, SXS500)
- OPTION XS-20 insulation resistance measurement up to 2 TΩ(DXS50, DXS500, SXS50, SXS500)
- OPTION XS-22 insulation resistance measurement display in (MΩ x km) (DXS50, SXS50, SXS500)
- OPTION XS-100 ETHERNET interface
- OPTION XS-101 ETHERNET + IEEE 488 interfaces
- OPTION XS-26 insulation resistance measurement with voltage from 20VDC up to 1000VDC.

- XS-90 technical manual with schematics
- XS-91-1 calibration kit for hipot AC/DC 50VA function
- XS-91-2 calibration kit for hipot AC/DC 500VA function
- XS-91-3 calibration kit for insulation resistance function
- XS-91-4 calibration kit for ground continuity function
- XS-96 SXSPro software to remote control XS series unit

Installation

Preliminary instructions

Warning : This unit must be used by qualified people. Every precaution for the use of units connected to the main must be taken during its use. In particular, this unit must be connected to earth .

The specifications of this manual, the correct operation of the unit as well as the operator's security are guaranteed only when the supplied accessories (TE54, TE56, CO175, CO183, CO184, ...) are used. The measurement probes can include limitation or protective elements, therefore it is forbidden to modify without written agreement from SEFELEC company.
In case of use under other conditions than the one specified in this manual, the security of the user will be in danger.

This unit can supply voltages and currents which could be lethal. Comply with the safety regulations related to the use of high voltage devices.

ALWAYS MAKE SURE THE HIGH VOLTAGE INDICATOR IS NOT ON WHEN CONNECTING OR DISCONNECTING THE SPECIMENS.

The XS series unit can be operated from either 115 or 230 volts ±10%, 47 to 63 Hz power line. Before connecting the 3 wires power cord (SE1) between the unit and AC power source, make sure the voltage indicated on the inlet module (Z8) is in accordance with the power source.

For a change of voltage selection, proceed as follows:

- Front panel ON/OFF switch in the OFF position
- Remove the power cord SE1 from the inlet module
- WAIT AT LEAST 5 MINUTES BEFORE PROCEEDING
- With a small screwdriver, remove the selection sub-assembly from the inlet module
- Remove the fuses
- Take off the pale gray plastic piece
- Select voltage : 110 for a 115 volts main and 220 for a 230 volts main (the 240 position is not used).
- Replace the gray plastic piece to display in the window of the selection sub-assembly the required voltage.
- Put the right value for the fuses according to the main voltage
- Replace the selection sub-assembly in the inlet module

Connect the SE1 power cord

Power ON

Make sure the voltage indicated on the inlet module (Z8) is in accordance with the power source. Connect the unit to the mains AC source (with earth connection) with the SE1 power cord then press the power button in the ON position.
After a few seconds the LCD screen must display the instrument model name:

fig 5.4

According to the position of the user related to the unit screen and the light conditions, it is possible to adjust the screen contrast by turning the potentiometer located on the rear panel (Z9).

Operator safety advices

WARNING : NEVER TOUCH THE METALLIC TIP OF THE HV TEST PROBES (TE54, CO177,...) WHEN THE TEST PROBES ARE CONNECTED ON THE UNIT AND THE RED HV LAMP IS ON.
The guard connection on the rear panel is at the measurement voltage (Umax = 1000 VDC – 2mA).
The measurement probes can include limitation or protective elements, therefore it is forbidden to modify without written agreement from SEFELEC Company.

- The instrument must be placed in a position where the ON/OFF switch can be easily accessible.

- Check the correct operation of cables before use.

- Take every precaution necessary to avoid inadvertently touching the sample under test when there is a voltage passing through it (front panel RED lamp on)

- Do not open the cover

- Do not place the unit close to a wall so that the air passes through the ventilation ears.

- The unit is supplied with a double « SAFETY LOOP » preventing generation of voltage. The test can be carried out only when pin 1 is linked to pin 9 AND pin 2 to pin 10 on the C5 rear panel screw terminal connector.

- Note: It is therefore advisable to put into operation in this connection, dry contacts in condition of safety (closed door, secured cover lowered,....)

- It is possible to connect a RED/GREEN lamp (CO160-XS) on the rear connector C5 in order to indicate in a visible way if the HV is ON or OFF on the outputs of the unit.

Connection to a specimen

Connection for the insulation resistance measurement and dielectric strength test (any model)

fig 5.5

- Connect the measurement probe (TE54, ...) on the B1 connector
- Secure the probe by tightening the knurled plastic ring
- Proceed the same way for the return probe (CO175) on the B2 connector.
- Connect the specimen to be tested as shown on the picture:

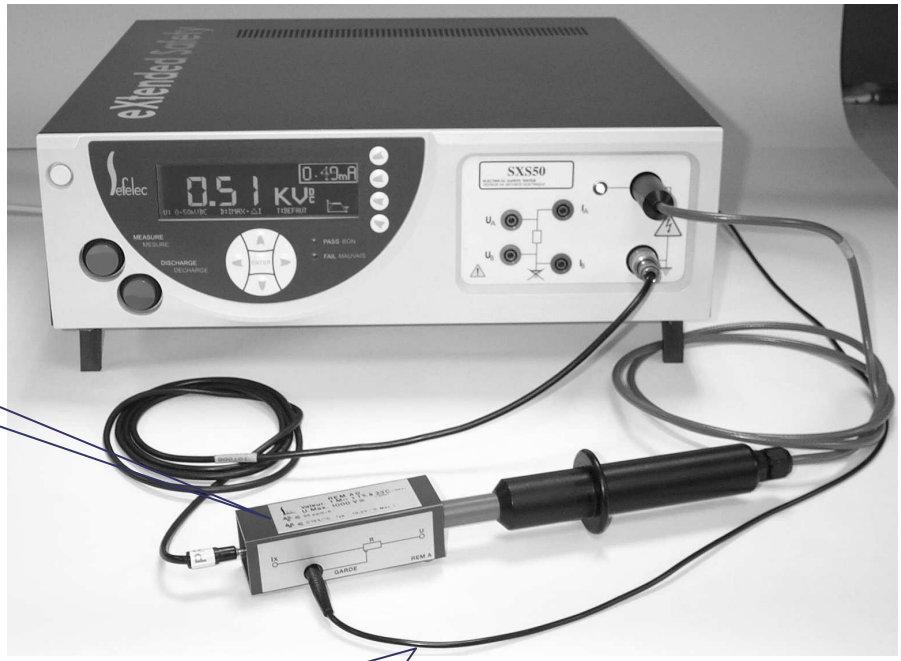

Specimen to be tested
Guard cable. Only necessary in Insulation resistance measurement for high values (R > 100 Gohms). **WARNING : the voltage can reach -1000VDC**

fig 5.6

Connection for the ground continuity measurement

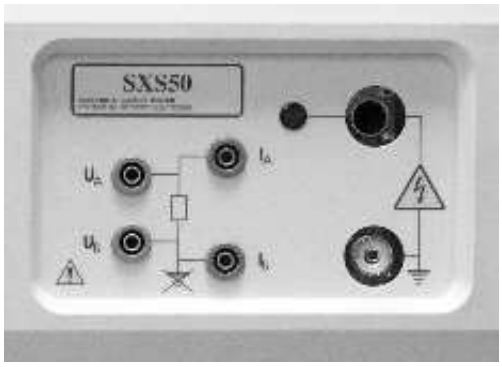


fig 5.7

- Connect the measurement probe (CO183 or CO184) on the UA, IA, UB, IB safety banana terminals (GREEN terminal = CURRENT, GREY terminal = VOLTAGE).
- Connect the specimen to be tested as follows:

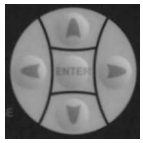
fig 5.8

WARNING : measurement of a specimen already connected to the earth.
When measuring a ground continuity on specimen already connected to the earth, it is mandatory to keep the accuracy specifications, not to connect the IB and UB terminals (label with a cross over the earth symbol) to the specimen side connected to the earth.

6 Unit configuration

After switching on or returning to the initialization menu, press the [SETUP] function key of the Z4 area. Then the LCD screen displays as follows:

fig 6.1

With the control keypad: 

With the UP and DOWN arrow keys, move the reverse video line and go into modification mode by pressing on the RIGHT arrow key or on the ENTER key (key at the center of the control keyboard). Scroll the possible selections with the UP and DOWN arrow keys, and then enter the choice with the validation key.

Language selection

All the messages on the LCD screen can be displayed in several languages (French, English, German, and Spanish). Display the required language with the UP/DOWN arrows, and then enter. The unit goes back to its initialization menu.

fig 6.2

Beep on FAIL configuration

When a test result is failed, a permanent audible signal is emitted by the unit until the removal by pressing on the [DISCHARGE] key. This function is active when **YES** is selected and not active when **NO** is selected. The choice is memorized after switching off the unit.

Filtering configuration for capacitive specimen

The FILTER function select a special operating mode of the unit when testing on capacitors or on specimens with a certain among of capacitance (cables,…).
Display the required mode with the UP/DOWN arrows: **NORMAL, CAPACITOR, R.H.TIME**..., then enter.

fig 6.3

(mode) CAPACITOR

The **CAPACITOR** mode allows to perform stable insulation resistance measurements on capacitive specimens (reel of cable, capacitors,...). During dielectric strength test with a DC voltage, the **CAPACITOR** mode inhibits the voltage adjustment to avoid over voltage, switches the 1.5 Mohm discharge resistor at the beginning of the fall time and controls the residual discharge voltage until this one is lower than 100 volts. Operating this mode is recalled by the drawing of a capacitor over the unity display in the measurement menus.

(mode) R.H.TIME (Real Hold Time)

The R.H.TIME (Real Hold Time) mode improves the operation of voltage ramp during the dielectric strength tests. It is suitable for tests using a DC high voltage on capacitive specimens. At the end of the rise time, the unit controls the output voltage and triggers the hold time only when the voltage has reached the pre-set value. During the fall time, the unit stops the measurement cycle when the output voltage is lower than 30 Volts.

(mode) NORMAL

The most common mode: linear rise and fall time (t< 3 sec.) with automatic test voltage adjustment at the end of the rise time.

Access control to the parameters

The access to the parameter modification can be secured by a password.
This limitation is made of three different levels:

(access) UNLOCKED

Let you modify all the parameters.

(access) READ ONLY

Let you only recall the memories but you can not modify them.

(access) LOCKED

You can not modify anything; security is total

When trying to modify the parameters in any of the 2 access controlled modes, the error message [ACCESS DENIED] is displayed.

Password programming

The password set up is in two steps, the password input and the security level input.
Password input or password modification is only possible when the PARAM ACCESS line displays FREE.

Move the reverse video line on the PARAM ACCESS and then Enter.
At the first unit power ON, the parameter access is UNLOCKED, and no password is activated.

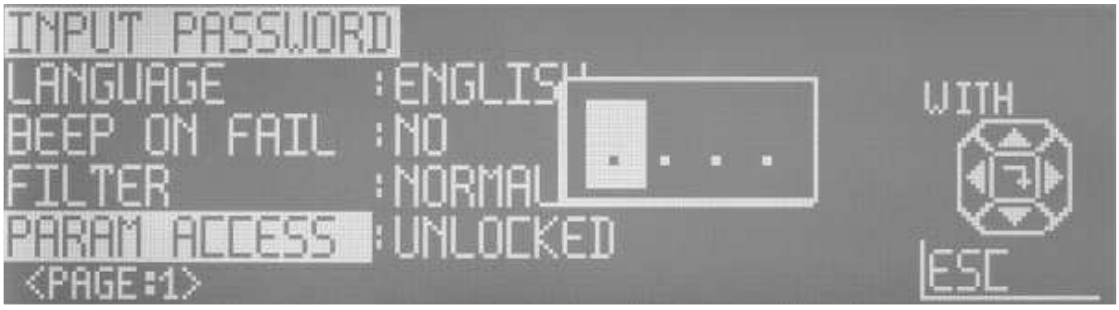


fig 6.4

To create a password and to select the access level (READ ONLY, LOCKED, UNLOCKED), proceed as follows:

- Select the figure position to modify with the right and left arrows.
- Increase or decrease the figures (0 1 2 3 4 5 6 7 8 9. 0 1 2...) to select your code. Repeat this action for each figure.
- Once the complete code is entered, validate with Enter key.

WARNING

The default configuration is with a void password.
A CORRECT PASSWORD IS A REAL (integer or decimal without point) NUMBER

If the code is not a real number, you will get an error and the following message «INPUT ERROR".

fig 6.5

In this example, you would get an error, because of the dot.
Then to correct you have to :

- Type a new password
- Or escape the password set up by clicking on ESC key

If the password is not correct, the following message will be displayed: "PASSWORD UNKNOW"

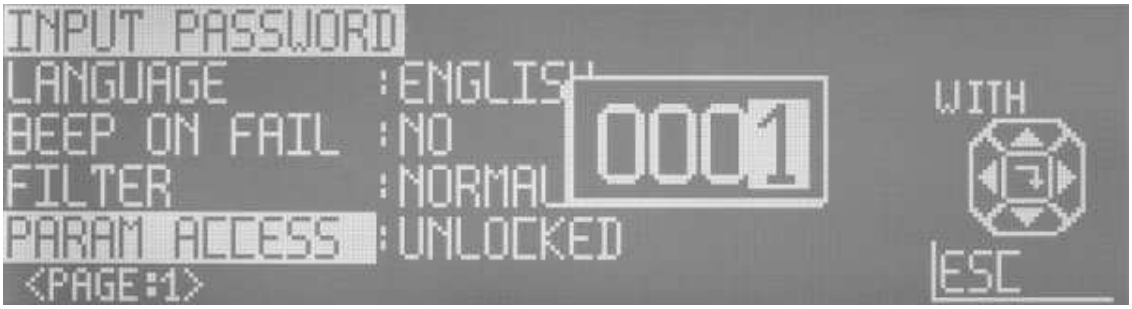
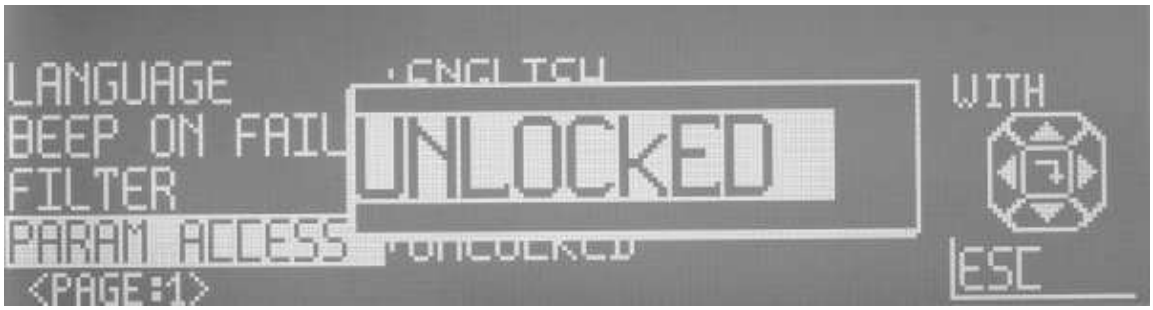


fig 6.6

Then to correct you can either:

- Type a new password
- Or escape the password set up by clicking on ESC key

If the password is correct, the following message will be displayed :



and you can select the security level : UNLOCKED, READ ONLY, LOCKED

fig 6.7

If you loose your password, please contact our service department or your distributor.

Sefelec service department : +33 (0)1-64-11-83-48

Measurement display

Press on the UP or DOWN arrows to select the next setup menu page .

fig 6.8

The DISPLAY function allows inhibiting the display of the digital measurement results, only the PASS-FAIL result is valid. This mode is especially interesting when controlling the unit by an external system (RS232C, IEEE488 or PLC) because it allows reducing the test times.
When operating this mode, a fixed drawing is displayed in the measurement result window:

Remote trigger mode

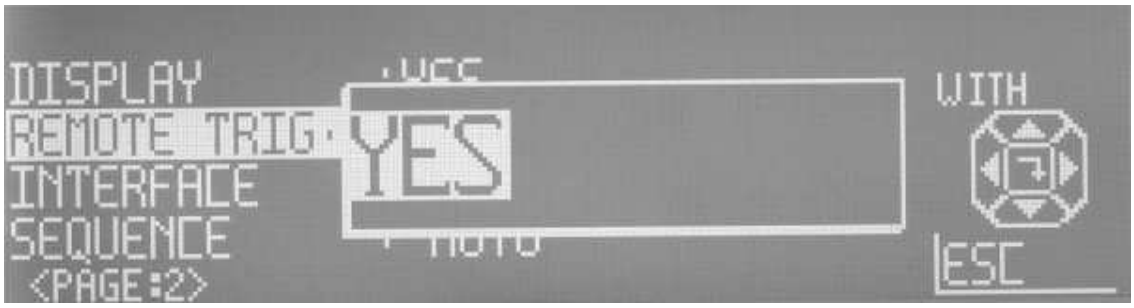


fig 6.9

WARNING :
This mode should not be used with the remote control accessories. (see section 11)

The XS series units have been designed to be directly triggered by a number of Sefelec accessories. The operation is fully safe, and the accessories are automatically identified.
If you are not using such remote control accessories you can even use a simple contact to trigger a measurement. This is possible through the REMOTE TRIG. mode.

The operation of this mode is reminded in the measurement windows by the following symbol :

Example with the Megohmmeter function :

fig 6.10

Electrical connection and trigger

Insert a contact between points 1 and 9 or 2 and 10 of the screw terminal C5 on the rear panel.
If you use points 1-9 for the external contact, a permanent link or the safety loop should exist between points 2-10 and vice versa.

IMPORTANT:

In the REMOTE TRIG. mode, the unit will stop the measurement but will not display any SAFETY LOOP open message.

If you have selected the **REMOTE TRIG.** mode and if the connections 1-9 and 2-10 are already done when selecting a measurement function (Megohm,Hipot, ….), the following message is displayed

INPUT ERROR

and the **REMOTE TRIG.** mode is automatically removed.
Please refer to the above procedure to select correctly the **REMOTE TRIG.** mode.

Interface selection

The XS series units can be remote controlled by the following interfaces:

RS232, IEEE 488 (GPIB), ETHERNET et par interface API.

At the same time, only one interface can be selected
If an interface is not installed in the unit, its selection displays an error message: OPTION MISSING.

For more details about those interface capability, please refer to the related section of this manual.

Sequence selection (Option 04)

For DXS models only, if the option 04 is installed, this function allows to to perform automatic cycling of the megohm and dielectric strength functions.
Display on the LCD screen the various sequence modes with the UP and DOWN arrows :

OFF,M+H,H+M,M+H+M,.....

The **M** letter shows an insulation resistance measurement and the **H** letter shows a dielectric strength test. Operating the sequence mode is recalled in the measurement windows by the following drawing symbol:

In a **M+H** sequence the unit performs first an insulation test and then a dielectric test. It is necessary to set the parameters specially the test times before running a sequence. In case of a fault during the test, the sequence is stopped. When operating in sequence mode, at power on, the first sequence function type is automatically selected. When attempting to trigger the measurement mode in a function type which is not the first one of the sequence, the following message is displayed:

SEQUENCE ERROR

Escape of the function and select either another function or another sequence mode.

Example of a sequence setup:
An operator wants to perform an insulation control on a specimen, then a dielectric strength test and finally a new insulation control to verify that the dielectric strength test hasn't degraded the specimen.

- SETUP menu
- <page2>, line SEQUENCE
- Select the sequence mode : M+H+M
- Escape with [ESC] key
- The unit switches automatically in the insulation test
- Check that parameters are correct (Necessary to select times)
- Press on the [MEASUREMENT-DISCHARGE] push button
- After the test time the unit switches automatically to the next test if the test result was PASS.
- When an insulation test has to be perform after a dielectric strength test, the unit controls the discharge voltage of the specimen and follows its sequence only if the voltage is lower than 100 volts with the display of :

DISCHARGE CONTROL

In case of a fault during the insulation test, the number 1 or 2 of the test is displayed.
At the end of a sequence, after release of the result by pressing the [MEASUREMENT-DISCHARGE] push button the unit switches in the first function of the sequence.
To escape of the SETUP menu, press on the function key [ESC].

[expert]

EXPERT mode Activation

fig 6.11

The EXPERT mode gives additional controls for function such as the dielectric strength test (breakdown detection mode and breakdown threshold values during the rise time)
This mode is only for skill operators.
Any information related to this operating mode is indicated with this label: ***[expert]***

7 Insulation resistance measurement

Press on the MEGOHM function key if displayed or from the initialization menu press on FUNCTION then MEGOHM.
The main test parameters are recalled on the bottom line of the LCD screen..

fig 7.1

Parameter setting

Press on the PARAM function key to enter the parameter setting screen.
If the message [ACCESS DENIED] is displayed, please refer to PARAMETER ACCESS CONTROL section

fig 7.2

Measurement voltage selection

The measurement voltage can be adjusted between 10 and 500VDC or 20 and 1000VDC (option 26) by 1 VDC step.

Move the reverse video line in front of the VOLTAGE line with the UP/DOWN arrows keys.
Press on the RIGHT arrow or ENTER key
Display shows :

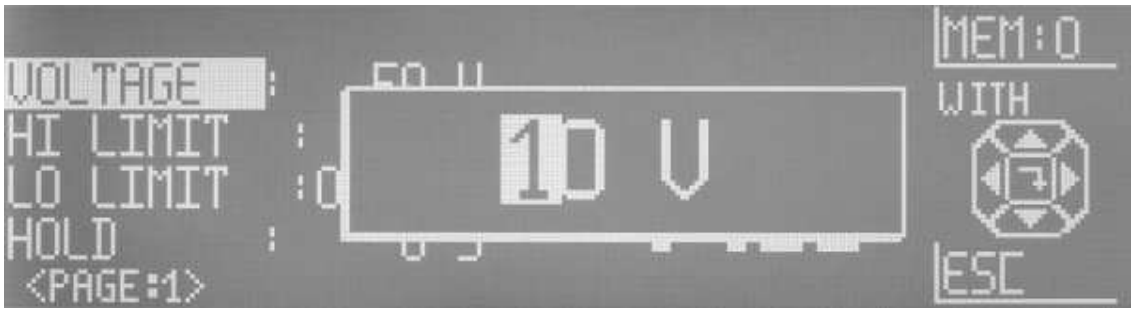


fig 7.3

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc)
Repeat operation for all the numbers if necessary

Measurement threshold selection

The unit includes 2 comparison thresholds making possible to check if the specimen under test is PASS or FAIL .
The **HI-LIMIT** defines the maximum insulation resistance value for the specimen in order to detect a possible bad connection of the test probes on the specimen.
The **LO-LIMIT** defines the minimum insulation resistance value that must be reached by the specimen under test.
A specimen is good (PASS) if its insulation resistance value is < HI LIMIT and > LO LIMIT, otherwise the specimen is declared bad (FAIL).
In the basic version of the unit the thresholds are adjustable from 0 kΩ up to 200.0 GΩ.
A **HI LIMIT** set to 200.0 GΩ cancels the comparison to the high threshold, in that case the value of the high threshold is not displayed on the parameters line of the figure 10.
When a value above 200GΩ (or 2TΩ according to the option) is entered, the message **LIMIT ERROR** is displayed.

Move the reverse video line in front of the HI LIMIT line.
Press on the RIGHT arrow or ENTER key

Display shows :

fig 7.4

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc)
Repeat operation for all the numbers if necessary

- With the RIGHT arrow key, move the cursor up to the unity zone
- Scroll the unity:
  KΩ (1 000 ohms),
  MΩ (1 000 000 ohms),
  GΩ (1 000 000 000 ohms)
  TΩ (1 000 000 000 000 ohms).

Enter the threshold with the ENTER key
WARNING : the HI LIMIT must be always higher than the LO LIMIT, otherwise an error message is displayed :

HI LIMIT < LO LIMIT

- To set the LO LIMIT value proceeds the same way as for the HI LIMIT.

WARNING: the LO LIMIT must be always lower than the HI LIMIT, otherwise an error message is displayed:

LO LIMIT > HI LIMIT

Timer operation

The unit is equipped with a timer to define the insulation resistance measurement time (from 1 up to 999 seconds). This feature is particularly interesting when measuring on capacitive specimens of which the insulation resistance increases as a function of the measurement time. At the end of the test time, the unit automatically stops the test and memorizes the last measured value on the LCD screen.
In case where a test time is set to 0, the unit remains in the measurement mode permanently until the [DISCHARGE] key is pressed.

To adjust the hold time

Move the reverse video line in front of the HOLD line
Press on the RIGHT arrow or ENTER key
Display shows :

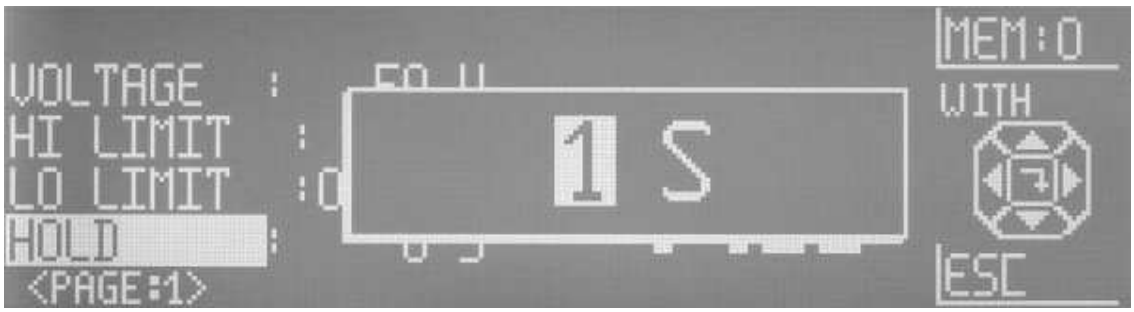
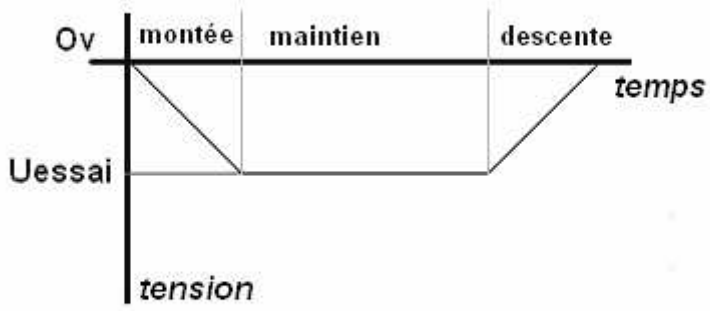


fig 7.5

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc).
Repeat operation for all the numbers if necessary
Enter the time with the ENTER key

To adjust the rise and fall time

Fast voltage rise and fall time can stress more than wanted the specimen under test.
To limit the risk, the unit is equipped with an adjustable slow rise and fall time for the measurement voltage.



REMINDER : the measurement voltage is negative .

To adjust the rise and fall times:

Move the reverse video line in front of the RISE or FALL line (Menu page 2)
Press on the RIGHT arrow or ENTER key
Display shows :

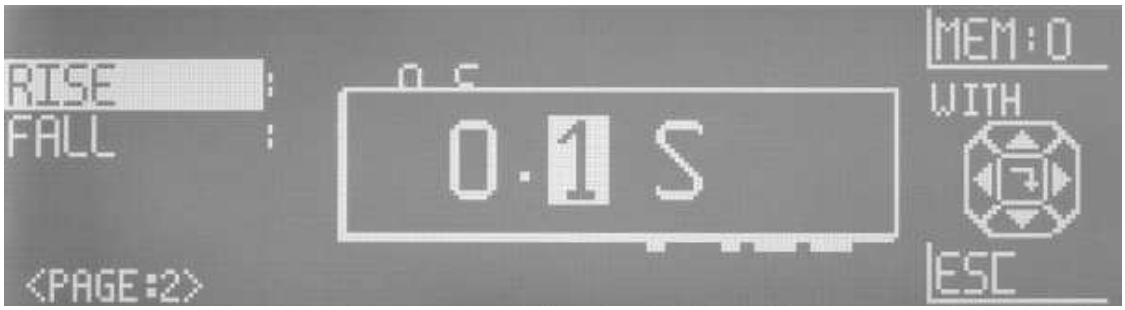


fig 7.6

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc).
Repeat operation for all the numbers if necessary
Enter the time with the ENTER key

If necessary, move the cursor on the unity area (S = seconds or V/s = volts per second). With the UP and DOWN arrows display the required unity and enter the unity with the ENTER key.

Parameter memorization

XS series unit allows to store in 10 memories (numbers 0 to 9) measurement parameters (voltage, threshold, time, ...). From the measurement menu, to modify the memory number :

Press on the [MEM:x] function key
Display shows :

fig 7.7

With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The parameters recall line (area 3 of the LCD screen) indicates the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

From the parameter menu, to modify a memory number :

Press on the [MEM:x] function key
With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The input parameters lines indicate the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

WARNING

ANY PARAMETER MODIFICATION IS AUTOMATICALLY STORED IN THE MEMORY

Insulation resistance measurement

Any measurement is performed by using the parameters stored in the active memory (see MEMx indication in the LCD screen right hand side)
Connect the measurement probe and the return lead on the specimen before starting the measurement by pressing on the green MEASUREMENT push button.

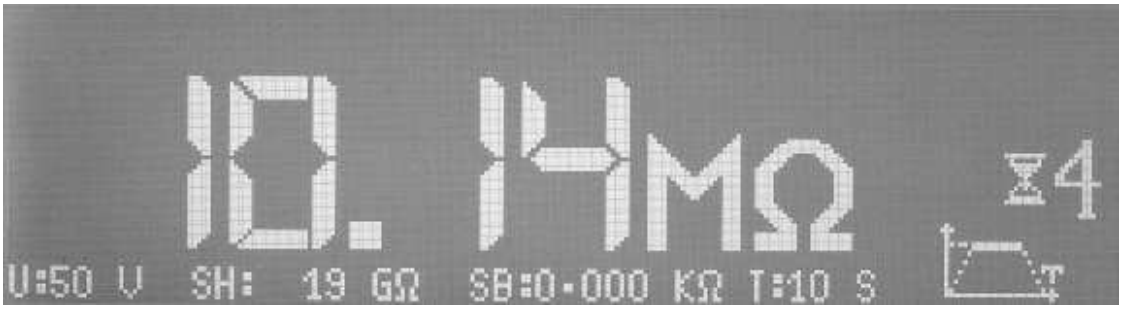


fig 7.8

IMPORTANT :

ALWAYS MAKE SURE THAT THE HIGH VOLTAGE INDICATOR (RED LAMP) IS NOT ON WHEN CONNECTING OR DISCONNECTING THE SPECIMEN.

In case where a test time is set to 0, the unit remains in the measurement mode permanently until the [DISCHARGE] red push button is pressed.
If a test time value has been selected, every second the value of the test time counts down one unit. When the displayed time reaches 0 the output voltage is cut off automatically and the last measured value is stored on the LCD screen. According to the insulation resistance value in comparison with the HIGH and LOW limits, the red LED (FAIL) or the green LED (PASS) is illuminated.

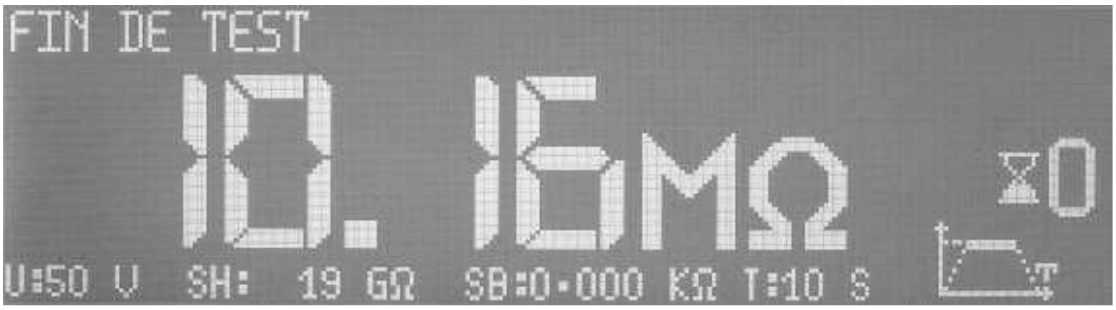


fig 7.9

Press on the [DISCHARGE] red push button to cancel the memorization on the LCD screen. (The HV indicator goes out.)
Display shows figure 11
Press on the [ESC] key to escape the function

Error messages

The following error messages may appear during the measurement:

(message) SAFETY LOOP

the safety loop is not closed. There is no connection between the points 1-9 and 2-10 of the C5 connector of the rear panel. Make the connection, press again on the [MEASUREMENT] green push button to trigger the measurement mode.

(message) OVER-RANGE

the insulation resistance of the specimen under test exceeds the measurement specifications of the unit (refer to specification section of this manual).

(message) UNDER-RANGE

the insulation resistance of the specimen under test is lower than the measurement specifications of the unit (refer to specification section of this manual).

(message) CHARGING

the measurement voltage has not reached its final value. On capacitive specimen, wait for the end of the charge, on resistive specimen check with the current specifications of the power supply.

(message) BOARD NOT READY

the microprocessor board cannot communicate with the insulation resistance board. You cannot perform a measurement, get in contact with our Service department (+33 1 64 11 83 48)

8 Dielectric strength test (hipot test)

From the initialization menu press on the [HIPOT] or on the [FUNCTION] then [HIPOT] function key to get the menu shown in figure 8.1.
The main test parameters are recalled on the bottom line of the LCD screen.

fig 8.1

Setting

To modify these parameters, press on the [PARAM] function key of this menu. If the message [ACCESS DENIED] is displayed, please refer to section PARAMETER ACCESS CONTROL
Then the display shows:

fig 8.2

Test voltage selection

The unit offers the possibility to select dielectric strength test voltages between 0.10 and 5.00 KVAC or 0.10 and 6.00 KVDC . The test voltage value selection is done according to the standards.
Move the reverse video line in front of the VOLTAGE line
Press on the RIGHT arrow or ENTER key
Display shows :

fig 8.3

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3, etc)
Repeat operation for all the numbers if necessary
With the RIGHT arrow key, move the cursor up to the unity zone
Scroll AC, DC (for XS56 and 506 models) with the UP/DOWN arrow keys

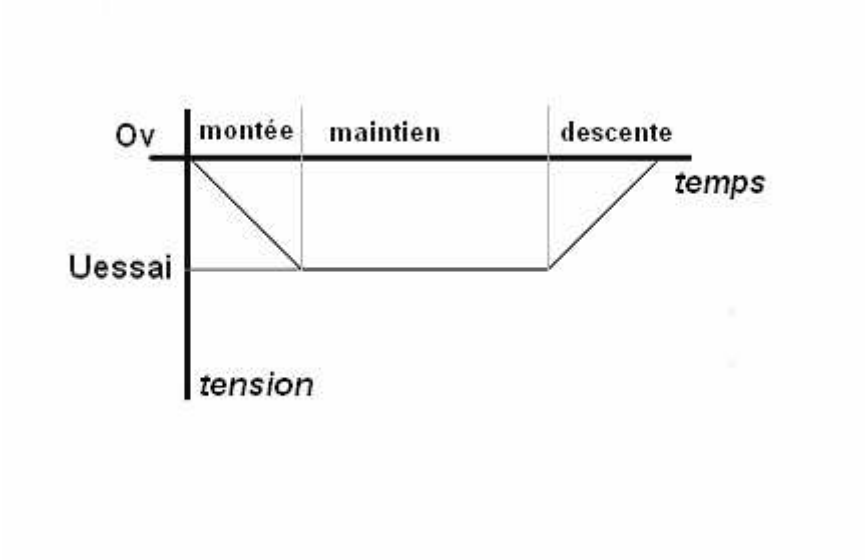
Enter the voltage with the ENTER key. If the value is higher than the maximum limits (5.00 in AC and 6.00 in DC), following error message appears :

LIMIT ERROR

Enter a correct value or [ESC]

Test voltage application on the specimen

The sudden application of the test voltage on a specimen can stressed it more than required. Therefore the unit is fitted with a voltage rise time system. The same phenomena existing during the cut off of the high voltage, the unit can perform the following test cycle :



REMINDER : with DC voltage , the voltage is negative.

To set the HOLD time

Move the reverse video line in front of the HOLD line
Press on the RIGHT arrow or ENTER key
Display shows :

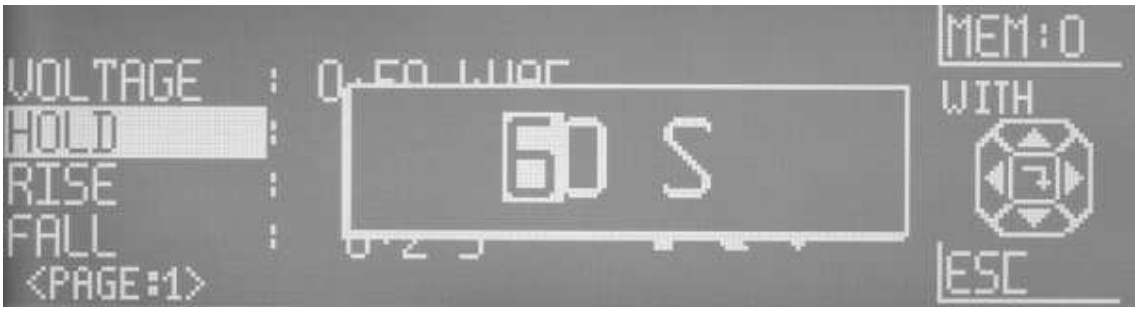


fig 8.4

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc)
Repeat operation for all the numbers if necessary
Enter the time with the ENTER key

To set the RISE and FALL times

Move the reverse video line in front of the RISE or FALL line
Press on the RIGHT arrow or ENTER key
Display shows :

fig 8.5

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc)
Repeat operation for all the numbers if necessary
Enter the time with the ENTER key

If necessary move the cursor on the unity area and scroll the items with the UP and DOWN arrows and then enter with the ENTER key.

REMINDER
The RISE and FALL times are adjustable from 0 to 1 sec. by 0.1 sec. Steps and from 1 to 999 sec. by 1 sec. Step.

Breakdown detection mode selection

fig 8.6

It is possible to select various breakdown detection mode.

Current variation mode : ΔI

The ΔTEST detector automatically carries out the subtraction between the current which flows normally in the device under test (I=U/Z) and the one which occurs at the time of a fault (I'=I+Ifault).

Maximum current limit : IMAX

The unit monitors permanently the current flowing through the sample under test and compares according the 2 following possibilities:

- The high limit (IMAX) > 0 , the low limit (IMIN) is set to 0
  - If the measured current is > or = to the IMAX, then the test is FAIL (breakdown)
- The high limit (IMAX) > 0 , the low limit (IMIN) is set to a value < IMAX
  - If the measured current is < IMAX and > IMIN then the test is PASS, otherwise the test is FAIL (breakdown or I < IMIN)

WARNING :
This detection mode can require between 200 and 300 msec. for the limit detection, and during this time the current can increase quickly over the limit .

Fast maximum current limit : F(ast)IMAX

Specifications are identical to the IMAX detection mode .
However in the FIMAX mode the breakdown detection is fastest (20 msec.) than in IMAX mode because the comparison with the current limit is performed directly by electronic circuits and not by the embedded software. The comparison accuracy is lower than the IMAX mode.

Fast maximum current and variation current limit : FIMAX + ΔI

This mode combines the FIMAX mode and the Delta I mode.

Maximum current and variation current limit : IMAX + ΔI

This mode combines the IMAX mode and the Delta I mode.

Without detection

In this mode there is no current monitoring.

There is no output high voltage adjustment according to the load.

Minimum current limit : IMIN

In the above detection modes it is possible to set a minimum value of current flowing through the specimen under test to insure that the specimen is correctly connected.
This mode is independent from the breakdown detection modes.

To set the detection mode :

Move the reverse video line in front of the DETECTION line with the UP/DOWN arrows keys.
Press on the RIGHT arrow or ENTER key
Display shows:

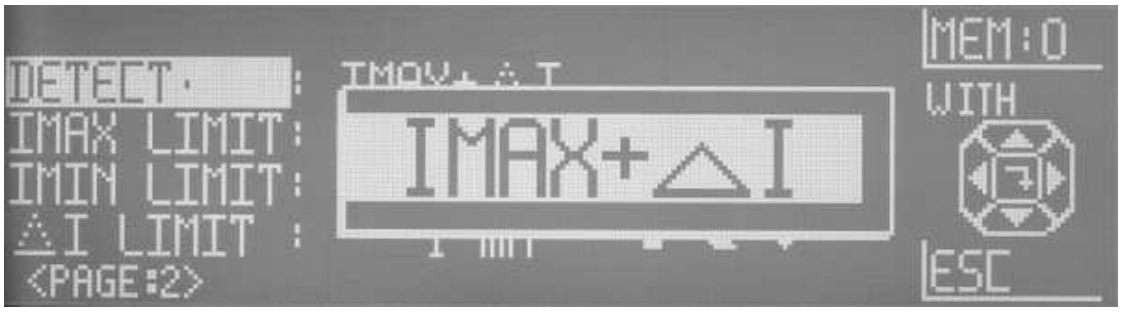


fig 8.7

With the UP/DOWN arrow keys scroll the various detection modes available :
Δ-I, IMAX+ Δ-I, IMAX, OFF, FIMAX+ΔI, FIMAX.....
Enter the selected mode with the ENTER key.

IMIN and IMAX threshold adjustment

The unit includes 2 comparison thresholds making possible to check if the specimen under test is good or bad.
The **IMIN LIMIT** defines the minimum current value which must flow through the specimen in order to detect a possible bad connection of the test probes on the specimen.
The **IMAX LIMIT** defines the maximum current value which is allowed to flow through the specimen under test.
According to the selected breakdown detection mode, a specimen is good (PASS) if the supplied current is < IMAX LIMIT and > IMIN LIMIT, otherwise the specimen is declared bad (FAIL).
The thresholds are adjustable from 0.00 mA up to 9.99 mA for 50VA and from 0.00 mA up to 99.9 mA for 500VA.
A IMIN LIMIT set to 0.00 mA cancels the comparison to the minimum current threshold.

Move the reverse video line in front of the IMAX LIMIT line
Press on the RIGHT arrow or ENTER key
Display shows :

fig 8.8

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 3 etc)
Repeat operation for all the numbers if necessary
Enter the threshold with the ENTER key

WARNING :
Start always by setting the IMAX limit. The IMAX LIMIT must be always higher than the IMIN LIMIT, otherwise an error message is displayed :

IMAX LIMIT < IMIN LIMIT

- To set the **IMIN LIMIT** value proceeds the same way as for the **IMAX LIMIT**.

  WARNING: the IMIN LIMIT must be always lower than the IMAX LIMIT, otherwise an error message is displayed :

IMIN LIMIT > IMAX LIMIT

Delta I level adjustment

The delta I breakdown detection level can be adjusted between 1mA/10µs and 10mA/10µs by 1mA/10µs step (50VA models) or from 10 mA/10µs to 100mA /10µs by 10mA/10µs step (500VA models) .

To adjust the delta I value :

Move the reverse video line in front of the SEUIL ΔI line
Press on the RIGHT arrow or ENTER key
Display shows :

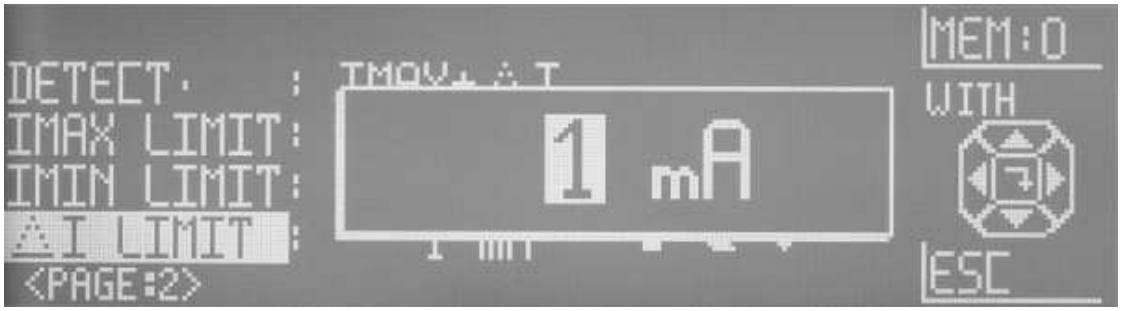


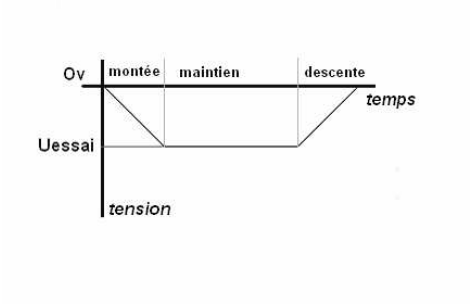
fig 8.9

Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys
Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9 0 1 2 3… etc)
Repeat operation for all the numbers if necessary
Enter the threshold with the ENTER key

Timer operation

There are four possible ways to use the unit timer : AUTO, DEFAULT, MANUAL, and U:2.

(mode) AUTO



In the AUTO mode the output voltage follows the above diagram with rise , hold and fall time.
During the HOLD time the output voltage on the specimen under test is adjusted to the preset value.

(mode) DEFAULT

After test start, the unit will stop the test only if there is a breakdown detection or if the operator press on the red discharge push button.
Rise and fall time are not used.
During the HOLD time the output voltage on the specimen under test is adjusted to the preset value.

(mode) MANUAL

The operator can adjust continuously the output voltage with the UP and DOWN arrow keys.
Automatic increase or decrease is provided in keeping the arrow key pressed more than 1 sec.

(mode) U:2

Operate as in AUTO mode , but start the output voltage not from 0 but from the test voltage divided by 2 .

To select the timer operation mode (HIPOT menu page 3)
Select the TIME line
Press on the RIGHT arrow key or on ENTER
The display shows:

fig 8.10

Scroll the timer operation modes with the UP and DOWN arrow keys, and then ENTER the selected mode.

Parameter memorization

XS series unit allows to store in 10 memories (numbers 0 to 9) measurement parameters (voltage, threshold, time , ...). From the measurement menu, to modify the memory number:

Press on the [MEM:x] function key
Display shows :

fig 8.11

With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The parameters recall line (area 3 of the LCD screen) indicates the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

From the parameter menu, to modify a memory number:

Press on the [MEM:x] function key
With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The input parameters lines indicate the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

WARNING

ANY PARAMETER MODIFICATION IS AUTOMATICALLY STORED IN THE MEMORY

Expert mode parameters only

[expert]

As explained before, the expert mode gives more controls to the unit to adapt the behavior of the unit regarding the user's need.

Breakdown detection mode selection during the ramps

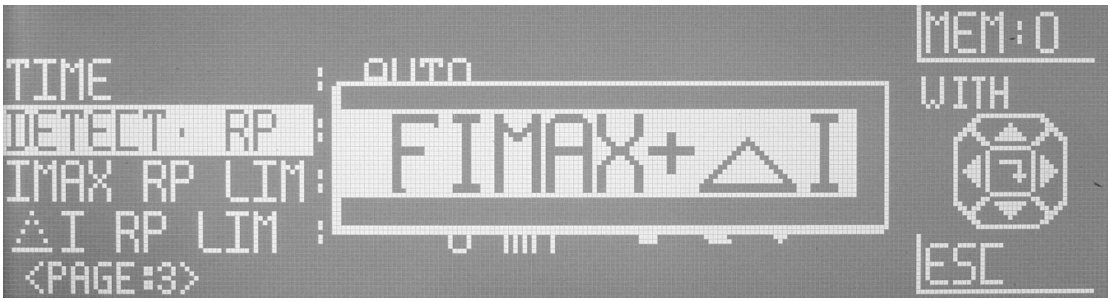


fig 8.12

It is possible to select a breakdown detection mode specifically for the ramps.
The ramps parameters are valid for the rising and falling ramps together.
As mentioned before, the breakdown detection modes are :
ΔI, IMAX+ ΔI, IMAX, OFF, FIMAX+ΔI, FIMAX

WARNING

IMAX and IMAX+ΔI modes involve that the current display is actived and the rising or the falling times are greater or equal to 2s

IMAX and delta I thresholds adjustment during the ramps

Refer in this chapter to the paragraphs *IMIN and IMAX threshold adjustment* and *Delta I level adjustment* how to set the values.

fig 8.13

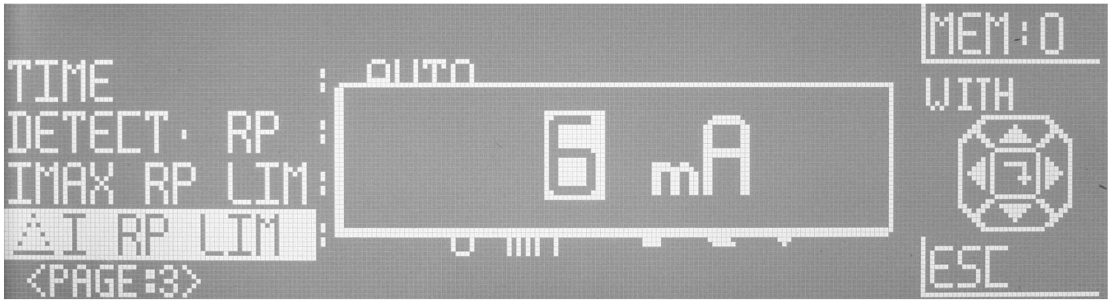


fig 8.14

Control of the display during the ramps

It is possible to have the display of the voltage and/or the current during the ramps, but select nodisplay of U or I provide a better linearity of the ramps.

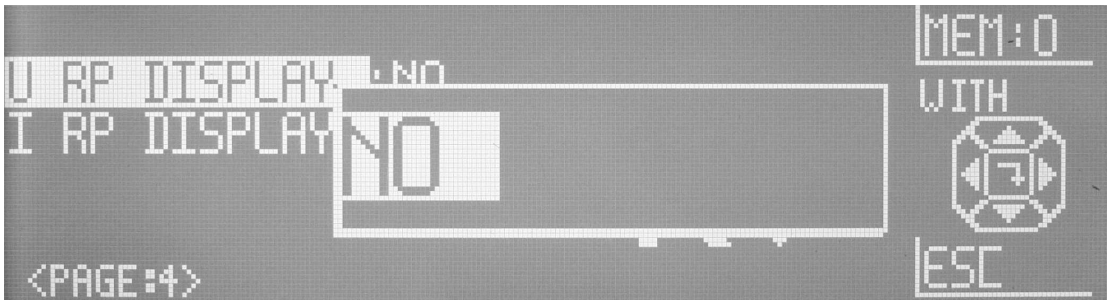


fig 8.15

Power mode for 60335 and 60204 standards

The European standards EN60335 and 60204 demand that the unit be capable to generate one current of 100mA AC minimum for tests voltages between 500VAC and 4000V AC.
To be conform set the option 335/204 STANDARD on.

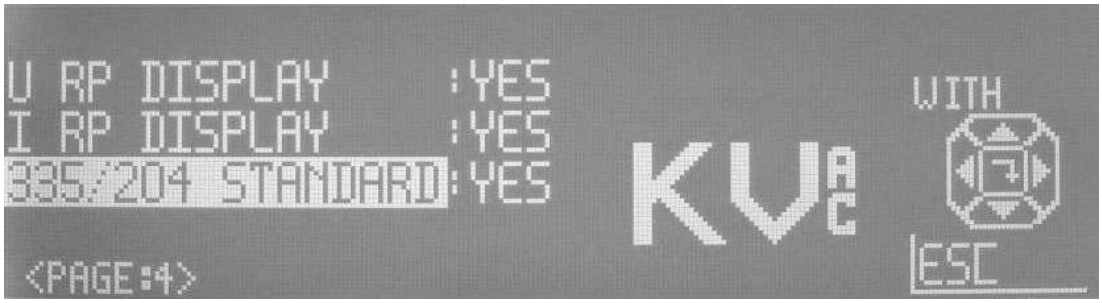


fig 8.16

For hipot tests under capacitive specimens , set FILTER : CAPACITOR in the menu unit configuration

Dielectric strength test (Hipot test)

Any measurement is performed by using the parameters stored in the active memory (see MEMx indication in the LCD screen right hand side)
Connect the measurement probe and the return lead on the specimen before starting the measurement by pressing on the green MEASUREMENT push button.

The red lamp « Danger, HV ON » lights and the display shows (in example) :

fig 8.17

IMPORTANT :

ALWAYS MAKE SURE THAT THE HIGH VOLTAGE INDICATOR (RED LAMP) IS NOT ON WHEN CONNECTING OR DISCONNECTING THE SPECIMEN.

In case where the MANUAL test time mode has been selected, the unit remains in the measurement mode permanently until the [DISCHARGE] push button is pressed.
Use the UP arrow key to increase the output voltage and the DOWN arrow key to decrease the output voltage. The maximum voltage which can be reached is those which is displayed on the parameter line :

VOLTAGE: x.xx KVAC

However according to the impedance of the specimen under test, the maximum reached voltage could be lower.

If the AUTO test time has been selected, every second the value of the RISE time counts down one unit, then the value of the HOLD time and at least the value of the FALL time. When the FALL time reaches 0 the output voltage is cut off automatically. According to the leakage current value during the test time in comparison with the IMAX and IMIN limits, the red LED (FAIL) or the green LED (PASS) is illuminated.

In both modes (AUTO and MANUAL) if the leakage current flowing through the specimen under test overruns the set breakdown detection values (in Δ-I or IMAX modes) the unit declares breakdown with cut off of the high voltage (at the next zero crossing).
The display shows :

fig 8.18

The memorized voltage is the breakdown voltage and the leakage current is also memorized and is corresponding to the IMAX value.

Press on the [DISCHARGE] red push button to cancel the memorization on the LCD screen. (The HV indicator goes out.)
Display shows figure 8.1
Press on the [ESC] key to escape the function

Dielectric strength test error messages

The following error messages may appear during the measurement:

(message) SAFETY LOOP

the safety loop is not closed. There is no connection between the points 1-9 and 2-10 of the C5 connector of the rear panel. Make the connection, press again on the [MEASUREMENT] green push button to trigger the measurement mode.

(message) VOLTAGE ERROR

the test voltage has not reached its final value (impedance of the specimen under test too low), in DC voltage wait for the end of the charge, in AC voltage check with the current specifications of the power supply. In case of over heating a built-in thermal switch cuts off the high voltage generator.
Wait for 3-5 minutes before going on.

(message) I<IMIN

during the HOLD time, the leakage current flowing through the specimen under test has not reached the minimum value set by the IMIN parameter (possible bad connection of the test probe). This fault gives a bad (FAIL) test result even there is no breakdown.

(message) SYNCHRO ERROR

the dielectric strength test board is not able to generate the sinusoidal signal which drives the HV transformer.
You cannot perform a test, get in contact with our Service department (+33 1 64 11 83 48)

(message) BOARD NOT READY

the microprocessor board cannot communicate with the insulation resistance board.
You cannot perform a measurement, get in contact with our Service department (+33 1 64 11 83 48)

9 Ground continuity resistance measurement

From the initialization menu press on the [GROUND] or on the [FUNCTION] then [GROUND] function key to get the menu shown in figure 9.1.
The main test parameters are recalled on the bottom line of the LCD screen.

fig 9.1

Setting

To modify these parameters, press on the [PARAM] function key of this menu. If the message [ACCESS DENIED] is displayed, please refer to section PARAMETER ACCESS CONTROL
Then the display shows :

fig 9.2

Measurement current selection

The unit offers the possibility to select ground continuity test current (step of 0.5 A).
The test current value selection is done according to the standards.

- Move the reverse video line in front of the CURRENT line.
- Press on the RIGHT arrow or ENTER key.
- Display shows :

fig 9.3

- Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys.
- Increase or decrease the value with respectively the UP and the DOWN arrow keys. Repeat operation for all the numbers if necessary.
- Enter the current with the ENTER key. If the value is higher than the maximum limits (5.0A-30.0A), following error message appears: **LIMIT ERROR**.
- Enter a correct value or [ESC]

Open circuit test voltage selection (6 or 12 VAC)

The unit offers the possibility to select ground continuity open circuit test voltage (6 or 12 VAC).
The test voltage selection is done according to the standards.

- Move the reverse video line in front of the VOLTAGE line.
- Press on the RIGHT arrow or ENTER key.
- Display shows :

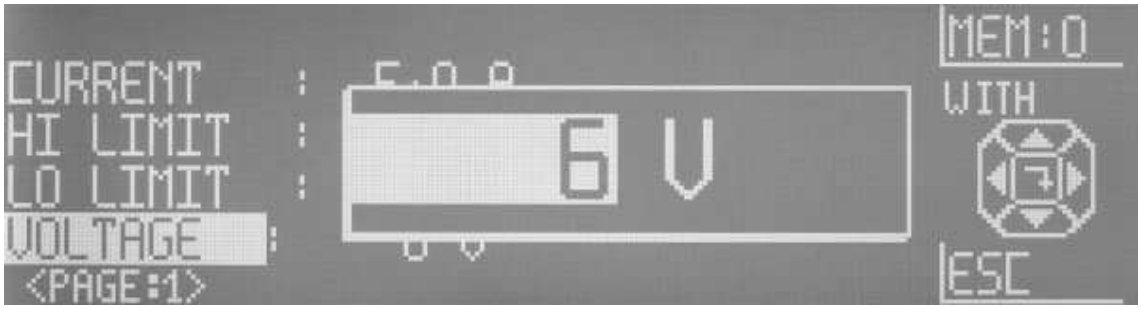


fig 9.4

- With the UP/DOWN arrow keys scroll all the available voltages (6, 12).
- Enter the selected value with the ENTER key.

Resistance threshold selection

The unit includes two comparison thresholds making possible to check if the specimen under test is good or bad.
These thresholds can be **a resistance or a voltage** (according to the requirements of standard **EN60204-1**).
The H LIMIT defines the maximum resistance value which is allowed for the specimen under test.
The L LIMIT defines the minimum resistance value in Ohms or Volts that can be reached by the specimen under test.
A specimen is good (PASS) if the resistance is under H LIMIT and over L LIMIT, otherwise the specimen is declared bad (FAIL).
Those thresholds are adjustable from 0 to 1500mΩ or 0.01V to 12.0V.

- Move the reverse video line in front of the H LIMIT line.
- Press on the RIGHT arrow or ENTER key.
- Display shows :

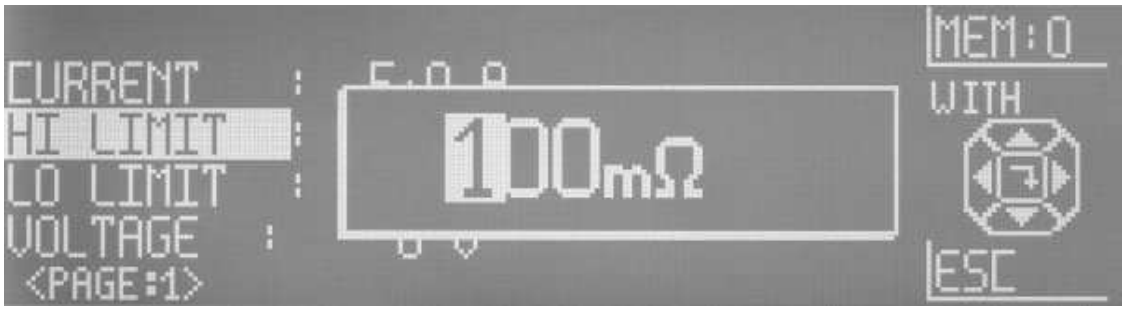


fig 9.5

- Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys.
- Increase or decrease the value with respectively the UP and the DOWN arrow keys (0 1 2 3 4 5 6 7 8 9. 0 1 2 ...).
- Enter the threshold with the ENTER key. Warning, the H LIMIT must always be higher than the L LIMIT, otherwise an error message is displayed :

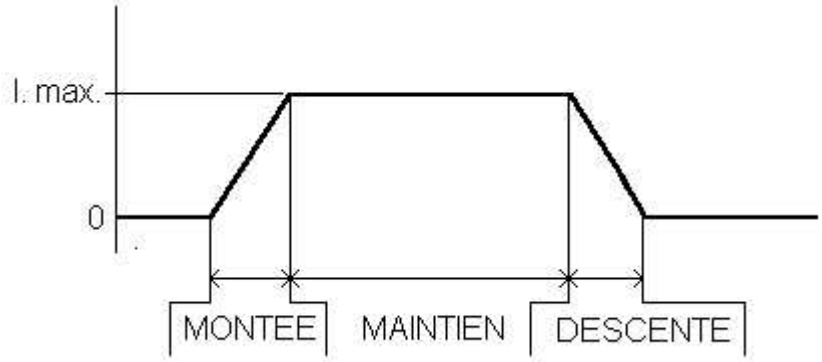
  H LIMIT < L LIMIT
- To set the L LIMIT value, proceed the same way as for the H LIMIT. Warning, the L LIMIT must always be lower than the H LIMIT, otherwise an error message is displayed :

  L LIMIT > H LIMIT
- If you whish to modify the unity (for instance switch from Ohm to Volt), use the right arrow as much times as you need to place the unity on reverse video. Then change it with UP and DOWN arrows.

Warning : when changing the unity (ohm to volt), you must enter again the two thresholds.

Timer operation

The sudden application of the test current on a specimen can stressed it more than required. Therefore the unit is fitted with a current rise time system. The same phenomena existing during the cut off of the current the unit can perform the following test cycle:



The three possible ways to operate the unit are the AUTO , DEFAULT and MANUAL modes.

(mode) AUTO

see above diagram.

(mode) DEFAULT

or “stop on default “is similar to the **AUTO** mode except that the test is stopped when the first FAIL measurement regarding threshold appears.

(mode) MANUAL

the current is permanently applied to the specimen under test .
The test will be stopped if the operator press on the red discharge push button.
Rise and fall time are not used.

From the parameters menu, press on the DOWN or UP arrow keys as many times necessary to display the following menu :

fig 9.6

- Move the reverse video line in front of the TIME line with the UP/DOWN arrows keys.
- Press on the RIGHT arrow or ENTER key.
- The display shows :

fig 9.7

- With the UP/DOWN arrow keys scroll the various available timer modes (AUTO, MANUAL).
- Enter the selected mode with the ENTER key.

In the AUTO mode, it is possible to set the RISE, HOLD and FALL times from 0 up to 999 seconds.

- Move the reverse video line in front of the HOLD line.
- Press on the RIGHT arrow or ENTER key.
- The display shows :

fig 9.8

- Select the number to be modified by moving the cursor with the RIGHT/LEFT arrow keys.
- Increase or decrease the value with respectively the UP and the DOWN arrow. Repeat operation for all the numbers if necessary.
- Enter the time with the ENTER key

Proceed the same way for the RISE and FALL times.

Parameter memorization

XS series unit allows to store in 10 memories (numbers 0 to 9) measurement parameters (voltage, threshold, time , ...). From the measurement menu, to modify the memory number:

Press on the [MEM:x] function key
Display shows :

fig 9.9

With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The parameters recall line (area 3 of the LCD screen) indicates the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

From the parameter menu, to modify a memory number :

Press on the [MEM:x] function key
With the UP/DOWN arrow keys, increase or decrease the memory number (from 0 to 9). The input parameters lines indicate the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the ENTER key.

WARNING: ANY PARAMETER MODIFICATION IS AUTOMATICALLY STORED IN THE MEMORY

Ground continuity resistance measurement

Any measurement is performed by using the parameters stored in the active memory (see MEMx indication in the LCD screen right hand side)
Connect the measurement leads on the specimen before starting the measurement by pressing on the green MEASUREMENT push button.

In the following example, the thresholds are in ohm. Priority is given to the resistance measurement , the voltage drop is recalled in a small window in the right hand side LCD screen corner.
If the thresholds are set in volts, the R and U display windows are exchanged.

fig 9.10

If the AUTO test time has been selected, every second the value of the RISE time counts down one unit, then the value of the HOLD time and at least the value of the FALL time. When the FALL time reaches 0 the output current is cut off automatically. According to the resistance value during the test time in comparison with the H LIMIT and L LIMIT limits, the red LED (FAIL) or the green LED (PASS) is illuminated.
At the end of the test, the unit cut off the current and END OF TEST appears at top of the screen.

fig 9.11

- Press on the [DISCHARGE] push button
- Press on the [ESC] key to escape the function.

Ground continuity measurement error messages

The following error messages may appear during the measurement:

(message) OVERRANGE

The ground continuity resistance is greater than the unit measurement specification.
Refer to the specification section.

(message) OVER HEATING

The unit is fitted with a thermal safety device on the current transformer set at 80°C.
Wait for 30 minutes before starting a new test.

(message) CONTINUITY ERROR

The measurement leads are not correctly connected on the specimen.
Or the resistance specimen is too high.

(message) BOARD NOT READY

the microprocessor board cannot communicate with the insulation resistance board.
You cannot perform a measurement, get in contact with our Service department (+33 1 64 11 83 48)

10 Sequence mode operation (SXS)

Any measurement function in the XS series is independent from the others.
The operator can decide about the parameter values and how to operate.
However the need to automate the electrical safety test request the capability to link the insulation, hipot and ground continuity tests with parameters according to standards or to internal company procedure.
The sequence mode gives the possibility to define and to link automatically all the tests according to the operator need.

Measurement function setting

To access to measurement functions, press the [FUNCT] key from the initialization menu, then press on the selected function key.

fig 10.1

Function not defined on the first screen, can be accessible with the [NEXT] key.

Sequence setting

Press on the [SEQ.] key from the initialization menu to obtain the next screen.

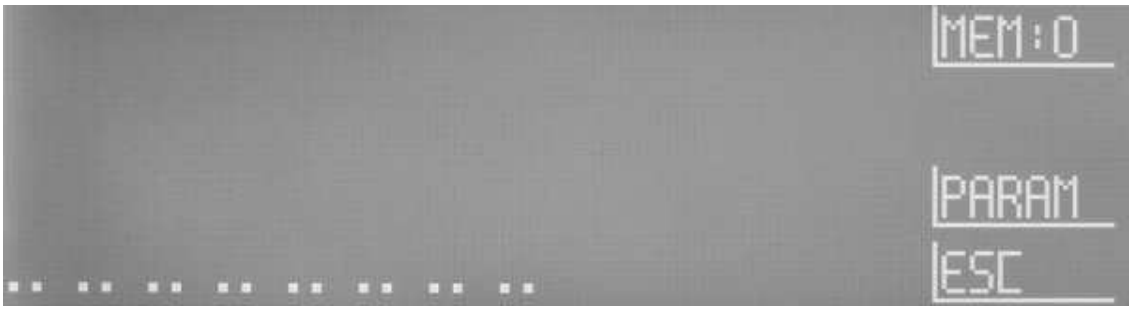


fig 10.2

A sequence describes an automatic or manual (see SETUP menu) link of measurements or tests.
Eight program lines are dedicated to the sequence description.
Each line contains a test, a measurement, a pause or a repeat function.
The LCD screen bottom line gives a summarized information on the active sequence (memory number in the LCD screen right hand side upper corner)
A sequence can be considered as a measurement function like the insulation measurement or dielectric strength test.

A sequence is started or stopped as a measurement function. The sequence stops if a measurement or a test result is failed.
If all the tests pass, the sequence result is PASS.

The contents of each line are described by 2 digits: for a function, the first digit sets for the type of test (M for Megohmmeter, H for Hipot, G for Ground continuity), the second digit referring to the number of the corresponding parameter set.
The 2 digits "**..**" feature an empty line, the word "**OK**" a pause between 2 functions and the operator "**x**" a multiple ground continuity test.

Parameter memorization

The unit contains 10 measurement sequences (numbered from 0 to 9) including up to eight different test steps. Each step corresponds to a test function associated to a parameter set, a pause between two tests or to the operating of several test points (at least 2) of the function defined on the previous line (multiple ground continuity).

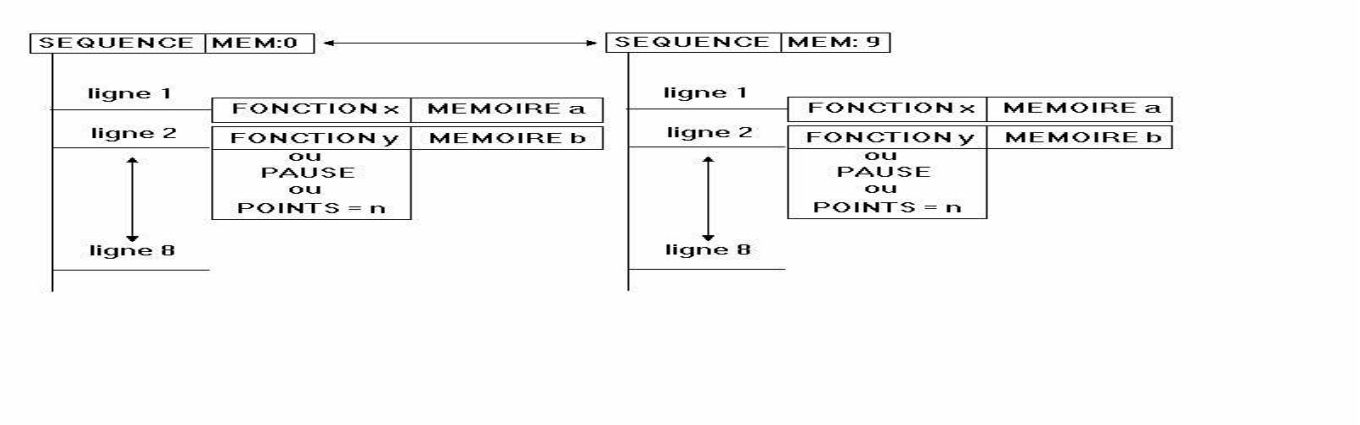


fig 10.3

On the above diagram, a and b represent the numbers of parameter sets associated to functions x and y chosen between those available (HIPOT, MEGOHM, GROUND, POINTS, and PAUSE) or EMPTY in case the test line is not used.

To modify the memory number from the measurement screen ,press on the [MEM:x] key.
Display shows :

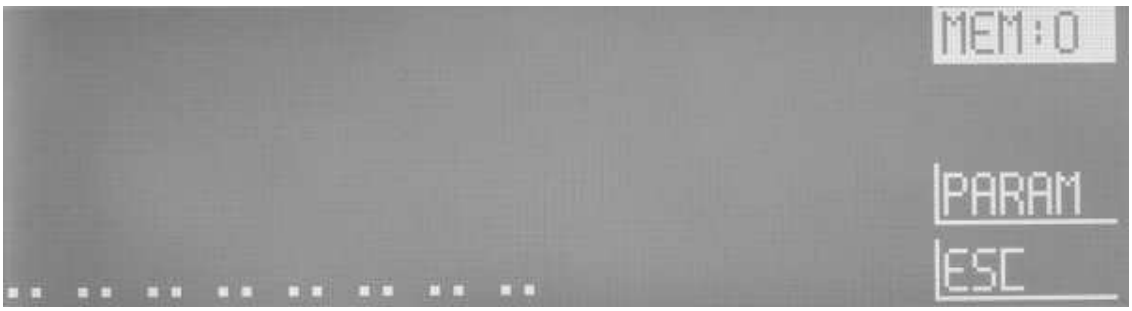


fig 10.4

With the up and down arrow keys, increase or decrease the memory number (from 0 to 9). The parameters recall line resumes the content of each memory.
Enter the selected memory either by pressing again on the [MEM:x] function key or by pressing the enter key.

WARNING
ANY PARAMETER MODIFICATION IS AUTOMATICALLY STORED IN THE MEMORY

Function selection

From the initialization menu, press on the [PARAM] key.
Display shows :

fig 10.5

Select the test to be modified and enter it with the enter key. Display shows :

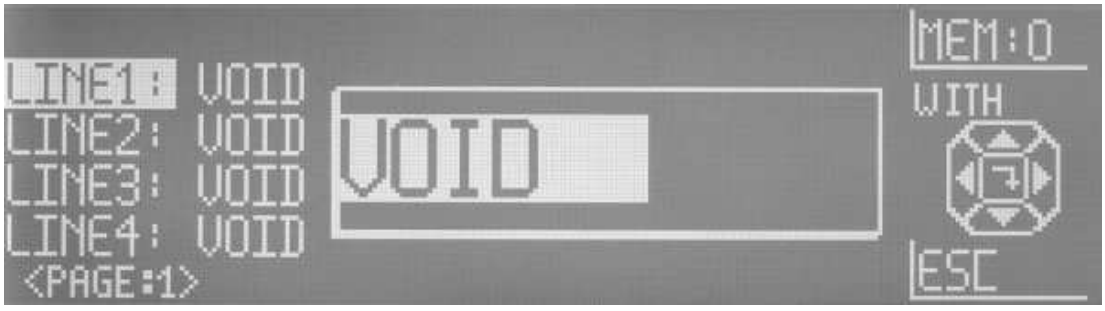


fig 10.6

Scroll the possible selection (HIPOT, MEGOHM, GROUND,PAUSE, POINT) with up and down arrow keys, then ENTER

fig 10.7

Parameter memory number selection

Select the memory number with the right arrow.

fig 10.8

With the up and down arrow keys, increase or decrease the memory number (from 0 to 9). Validate the function with its number memory by pressing on the ENTER key.
Then enter the function and its memory number with the ENTER key

Series of tests with manual control

By default, the proceeding of a sequence is automatic. For instance, in the case of a sequence including the following lines :

LINE 1 : MEGOHM 3
LINE 2 : HIPOT 4

The hipot test will be carried out immediately after the insulation measurement without intervention of the user.
It is possible to control the step from one function to the other by inserting a pause between the lines.
The sequence will be as follows:

fig 10.9

How to run a simple sequence

From the measurement screen, press on [MEASUREMENT] button

WARNING,
Never touch the specimen under test when it is connected to the unit and the red lamp is ON.

The tests are performed automatically and each result is displayed at the test end on the corresponding program line.
At the end of the complete sequence the END OF TEST message is displayed.
All the test result steps are accessible on the LCD screen. Use the UP and DOWN arrow keys to scroll the results and the pages.

fig 10.10

Press on DISCHARGE button to clear the screen and escape the sequence mode with ESC key.

WARNING
Pressing on DISCHARGE button clears the screen and therefore the test results.

Sequence with manual control

It is possible to control manually the sequence (see SETUP menu, line SEQUENCE=MANUAL)

In our example:
The unit performs the first function (Megohm 3), then it stays in standby mode and displays:

fig 10.11
The unit waits for the operator pressing on the ENTER key.

Multiple ground continuity

According to the specimen under test it may be necessary to perform several ground continuity measurements on several measurement points.
This feature is called Multiple ground continuity and it is displayed as follows:

fig 10.12

In the above example, the operator has to test with the same parameters, consecutively 2 ground points.
The minimum number of ground continuity test points is 2 and the maximum is 99.

Multiple ground continuity operation

With the above example, after starting the test the LCD screen shows :

fig 10.13

The unit waits that the operator press on the ENTER key (or press on the remote control bush button on the test probe if featured) to start the ground continuity test step (STEP:1)
Then the first step is proceeding.
The first line displays the measurement result.
And the LCD screen shows:

fig 10.14

As previously the unit goes in standby, waiting for ENTER pressing.

This is done as many times as the number of test steps if the test results are PASS.
Otherwise, the unit offers to the operator the possibility to re-test the FAIL test or to stop the Sequence (press on ESC).

Multiple ground continuity followed by a dielectric strength test (automatic sequence)

fig 10.15

The case of a multiple continuity immediately followed by a strength test requires a precise care.
The multiple ground continuity function means that the user sometimes enters the security area or is in direct contact with the specimen under test.
For that reason, in order to protect the user's safety, the unit stops the proceeding of the test before starting the strength test.

At this stage, test can be released by :

1. T**he keyboard :**
Press [ENTER] and then [LOW ARROW] within 0.5 sec. and keep this last key pressed until it is taken into account.

2. **Using the safety loop :**
If the safety loop is open during or at the end of the multiple continuity test, closing of the safety loop will start the strength test.

Error messages for the Sequence mode

(message) SAFETY LOOP

The safety loop is not closed. There is no connection between the points 1-9 and 2-10 of the C5 connector of the rear panel. Make the connection, press again on the [MEASUREMENT] green push button to trigger the measurement mode.

(message) BOARD NOT READY

The microprocessor board cannot communicate with the insulation resistance board.
You cannot perform a measurement, get in contact with our Service department (+33 1 64 11 83 48)

(message) PARAMETER ERROR

One or several parameters set for one of the sequence test is not compatible with the sequence operation (i.e. in hipot , line TIME= MANUAL).
Check the parameters for all the test steps.

(message) SEQUENCE ERROR

- Only 1 point in a multiple ground continuity
- A PAUSE must be between 2 test steps
- Several consequently PAUSE

(message) SETUP ERROR

In the SETUP menu, on the line INTERFACE , the option WITHOUT has to be selected.

11 Accessories with remote control feature

Accessories type

Some accessories in the XS series are equipped with a remote control push button to trigger the measurement start and stop.
Those accessories are sorted in two categories:

- Type 1 : For insulation and hipot test (ex : TE 58 xs)
- Type 2 : for ground continuity (ex : TE 81 xs)

There is at least one accessory with remote control for each measurement function.
Their operation is very simple and fully automatic.

Connection

The remote control accessories are supplied with a sub D 15 pin connector.
Detection and identification are fully automatic.
The connection on the unit is done on any of the C1 to C3 connectors available on the rear panel.
A maximum of three accessories can be connected at the same time.

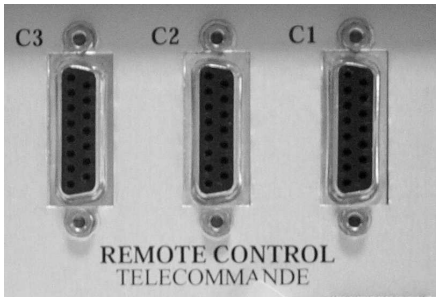


fig 11.1

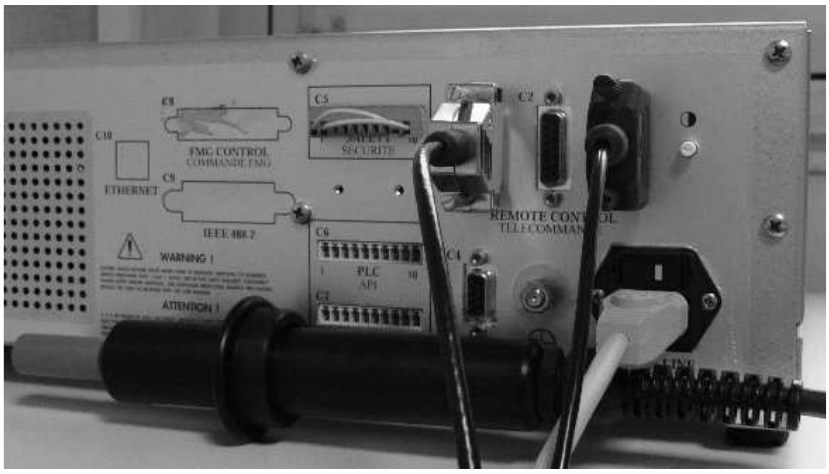


fig 11.2

Operation

A remote control accessory can be connected at any time except during the measurement time.
Inside a measurement function, the unit sends a beep to indicate the accessory connection and the unit sends a double beep to indicate the disconnection.
A small icon on the LCD screen indicates the remote control accessory connection as well as the accessory type (1 or 2).
Pressing on the remote control push button will start the measurement.
The push button has to be kept pressed all along the test time.
Releasing the push button will stop immediately the test.

NB : For safety reason, it is no more possible to start a test from the green front panel push button when a remote control accessory is connected.

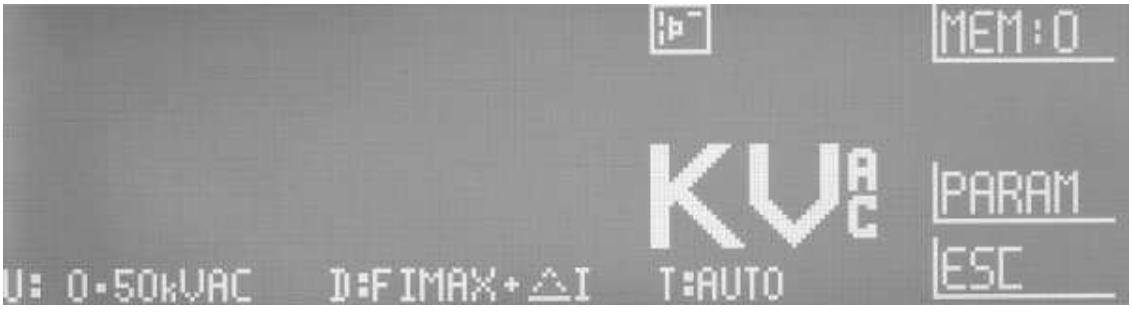


fig 11.3

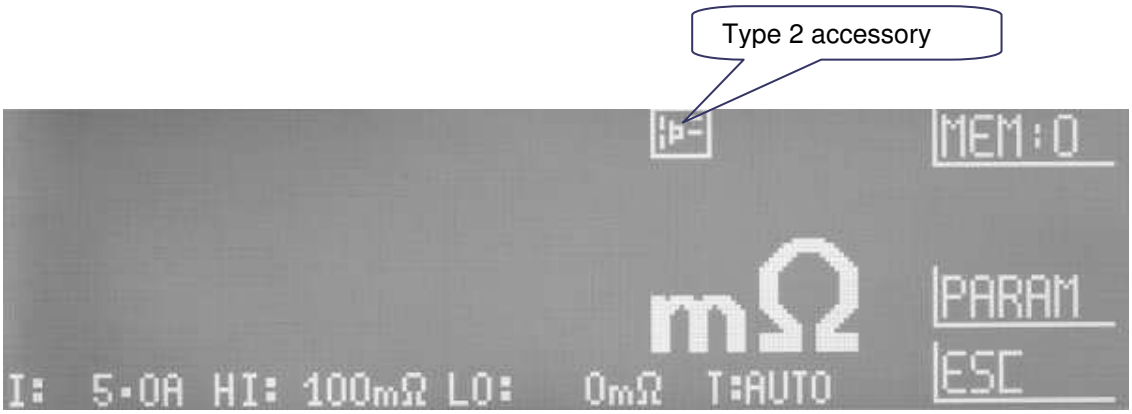


fig 11.4

Specific case for the sequence (SXS50 & 500)

Sometime the Sequence needs the use of 2 remote control accessories.
Considering a sequence with multiple ground continuity test followed by a hipot test .

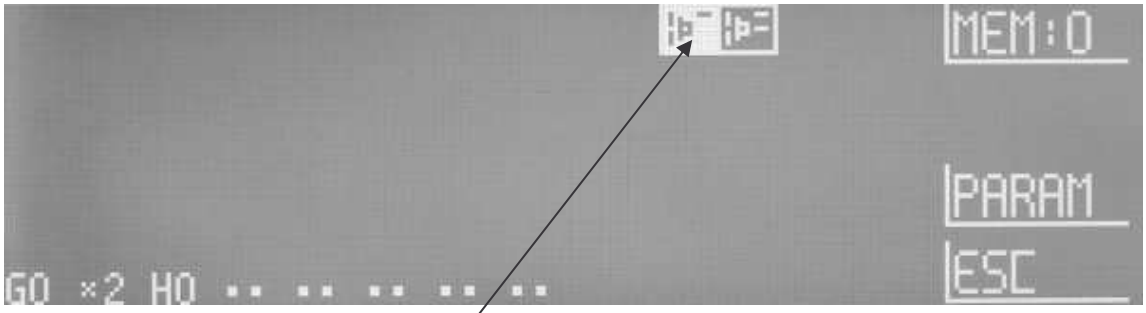


fig 11.5

At the sequence start, the unit inhibits the accessories which not compatible with the measurement function first step.
In our example, the type 1 accessory is inhibited (icon in reverse video mode).
Therefore it is not possible to start the sequence from the remote control accessory dedicated to the hipot or insulation resistance test.

To summarize:

- As soon as a remote control accessory is connected and accepted by the unit, the MEASUREMENT green push button is inhibited.
- Measurement start is only possible from the correct accessory regarding the measurement type described in the first line of the sequence (LINE 1)
- According to the measurement type the remote control accessories are in operation or not.

12 Input output Interfaces

Input-Output for Programmable Logic Controller Interface (PLC)

This option gives a functional control of the measurement unit by a Programmable Logic Controller system.

WARNING
The PLC interface must be selected in the SETUP menu, line INTERFACE :PLC

Electrical specifications

INPUTS :

- Number : 7
- Type : Optoelectronic
- Input resistance : 1.5 kohms
- Minimum voltage : 11 VDC or 8 VAC
- Maximum voltage : 43 VDC or 30 VAC

OUTPUTS:

- Number : 5
- Type : Dry contacts
- Maximum voltage : 70 VDC
- Switching rating : 30W
- Maximum current : 0.15 ADC

Description of the logical states

Input :
Logical state HIGH : DC or AC voltage with an amplitude between Umin and Umax.
Logical state LOW : no voltage.

Output :
Logical state HIGH : closed contact.
Logical state LOW : opened contact.
.

Connections

The Input Output signals are available on the unit rear panel on screw terminals C6 and C7.

Warning : each screw terminal has a key to avoid wrong connection.

Connector C6

1	IN010V
2	OUT010V
3	GND10V
4	+25V [1]
5	COMIN
6	CTRLIN
7	N0
8	N1
9	N2
10	N3

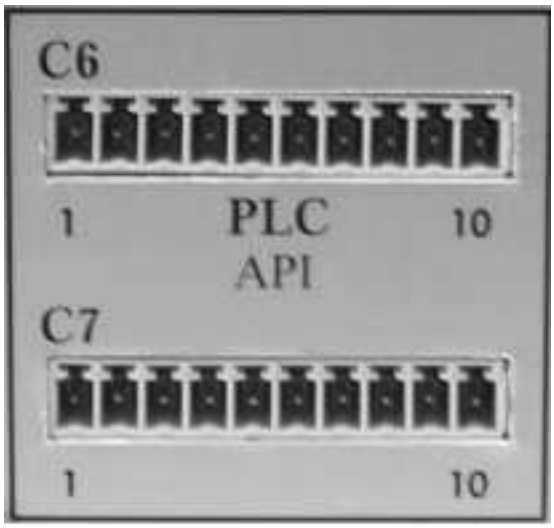


fig 12.1

Connector C7

1	TYPE
2	MESDCH
3	DTR[2]
4	COMOUT
5	CTRLOUT
6	PLCFAIL
7	EOT
8	PLCPASS
9	ERROR
10	GND

[1] Internal 25VDC power supply none regulated and protected by Polyswitch fuse with a maximum current of 1A. If the Polyswitch breaks the circuit in case of over current, please reduce the external current consumption and wait for a few minutes before trying again

[2] DTR input: not used in the XS series. Don't connect any signal on that pin.

Description of the input output signals

COM_IN : electrical common between input signals.

COM_OUT : electrical common between output signals.

CTRLIN (input) : request for remote control of the measurement unit.

TYPE (input) : selection of the measurement function (DXS models only)
Logical state HIGH : Megohmmeter.
Logical state LOW : Strength Test.

MES_DCH (input) : selection of the measurement or discharge state :
Logical state HIGH : Measurement
Logical state LOW : Discharge

N0,N1,N2,N3 (input) : binary coded data lines for the number of the parameters set :

N3	N2	N1	N0	Memory
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
0	1	0	0	8
1	0	0	1	9

CTRLOUT (output) : acknowledgment of the CTRLIN signal.

EOT (output) : the contact of the relay is closed at the end of the test.

PLCPASS (output) : the contact of the relay is closed when the test pass.

PLCFAIL (output) : the contact of the relay is closed when the test fail.

ERROR (output) : the contact of the relay is closed when an error occurs:
‘CHARGE', 'OVERLOAD', 'OVERVOLTAGE', 'BOARD NOT READY', 'SYNCHRO ERROR', 'INTERLOCK DISABLE', 'VOLTAGE ERROR'…

Measurement discharge cycle

Warning :
The PLC function must be selected in the configuration menu (line INTERFACE : PLC).

To take the control of the unit, you must be on the initialization screen.
If not, you will have the DIALOG ERROR : <2> message displayed.
Note : For DXS models in sequence mode, the control is taken from the measurement screen of the first sequence function.

To do a measurement :

- CTRLIN must be on high logical state,
- For the DXS models, the programmable logic controller must select a measurement function (Megohmmeter or dielectric strength test). For the other models it is advised to let the TYPE line not connected.
- The programmable logic controller has to select a number of parameters which will be binary coded with N0 to N3 bits (N0 is the least significant bit and N3 is the mot significant bit).
- To enter in measurement mode, a rising edge must be put on the MES_DCH line. The high logical state must be set all during the measurement. **Input states (**CTRLIN, TYPE, N0, N1, N2 et N3) **are enabled only on a rising edge of MES_DCH.**
- Then the unit will do a measurement or, if parameters aren't correct, will give an error. The CTRLOUT signal will appear at the first measurement and stay until a low logical state is set on the CTRLIN. During measurement, the unit will send various signals according to the test running and the selected parameters. Those parameters can be an error signal (ERROR), an end of test signal (EOT), or a signal showing the test result (PASS or FAIL). Those signals are active on a high logical state.
- For the SXS models, the PLC function starts only a sequence.
- For the DXS models the PLC function starts a measurement function or a sequence.

To force the unit to go in the discharge state, the programmable logic controller must set a low logical state on the MES_DCH input.
To reset the unit to the local mode, the programmable logic controller can reset the CTRLIN signal to release the CTRLOUT, then set the MES_DCH and reset it.(see diagram n°1)

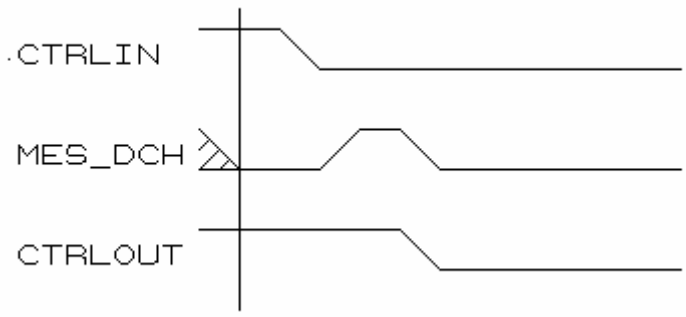


Diagram n°1 : release of the CTRLOUT signal

Information on cycle timing

Minimum cycle timing in dielectric strength test (hipot test)

Measurement conditions :

Software revision	
Measurement display	NO (second page of the setup menu)
Interface	PLC
Rise time	0
Fall time	0
Hold time	1
Time	AUTO
Other parameters	independent

- Test time = time between change of the MES_DCH (start test) signal and change of EOT (end of test) signal = **980 mS**
- *Measurement parameters :* same as above but with hold time = 0
  Test time = **700 mS.** In this case there is no output voltage control.
- *Measurement parameters :* memory number change between each measurement
  Test time = basic minimum test time + **1.3 S**

Minimum cycle timing in MEGOHMMETER

Measurement conditions :

Software revision	
Measurement display	NO (second page of the setup menu)
Interface	PLC
Measurement time	0
Other parameters	independent

- Test time = time between change of the MES_DCH (start test) signal and change of EOT (end of test) signal = **1.58 S**
- *Measurement parameters :* memory number change between each measurement
  Test time = basic minimum test time + **1.3 S**

Minimum cycle timing in GROUND CONTINUITY

Measurement conditions :

Software revision	
Measurement display	NO (second page of the setup menu)
Interface	PLC
Rise time	0
Fall time	0
Hold time	1
Time	AUTO

- Test time = time between change of the MES_DCH (start test) signal and change of EOT (end of test) signal = **1.19 S**
- *Measurement parameters :* memory number change between each measurement
  Test time = basic minimum test time + **1.3 S**

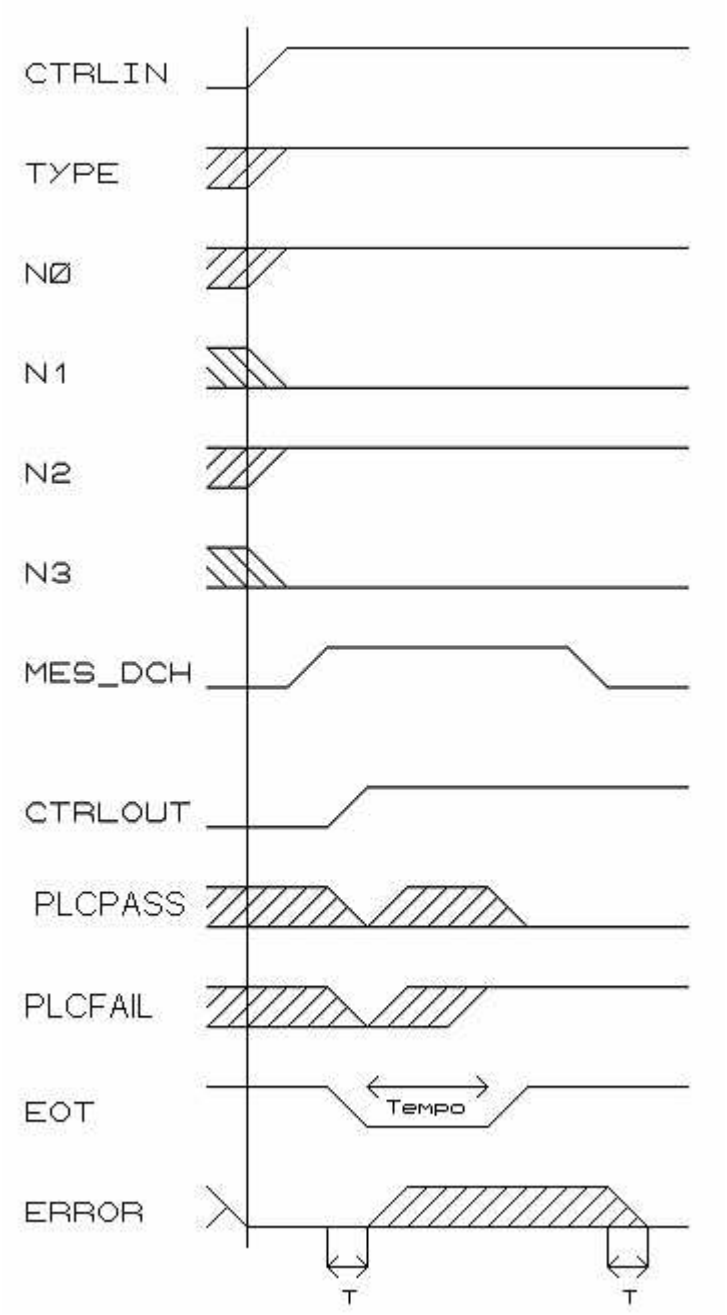


Diagram n°2 : Test example test with megohmmeter function on DXS models Memory 5 - Test failed.

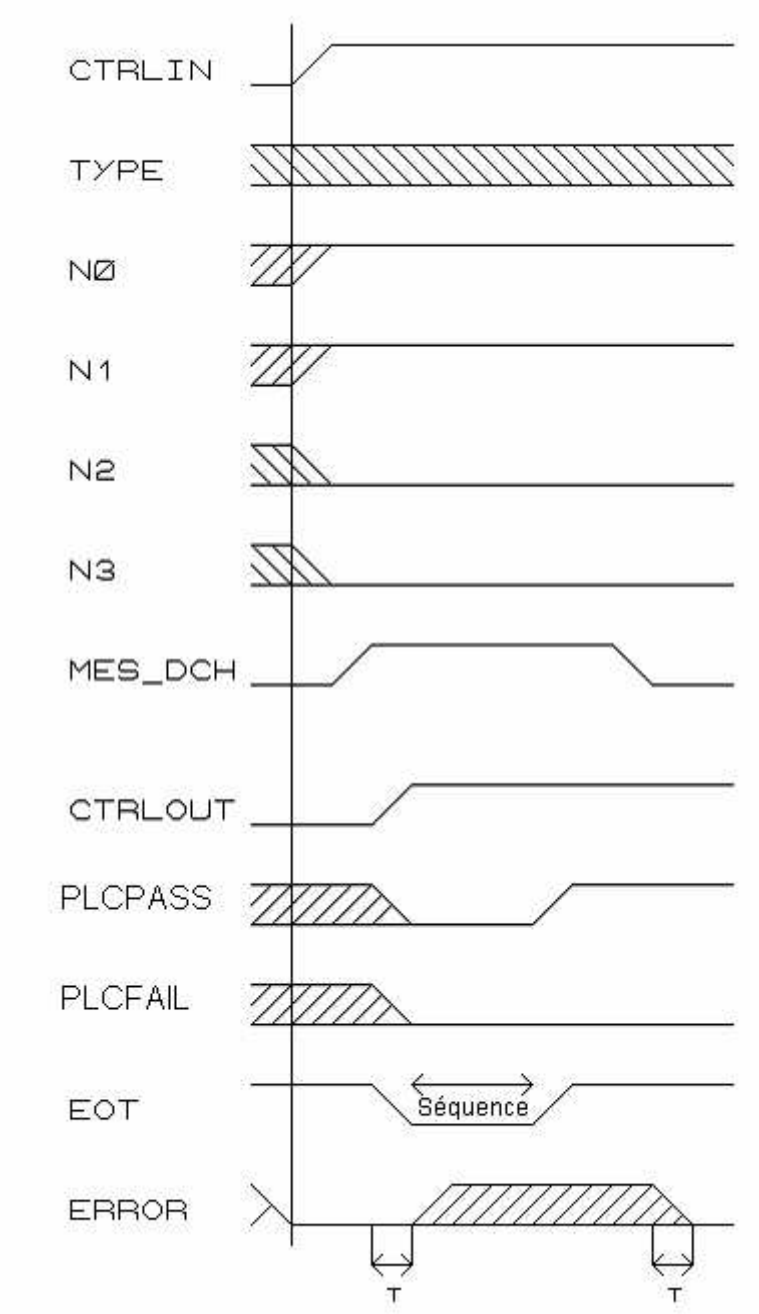


Diagram n°3 : Test example with hipot test function on SXS models
Memory 3 - Test passed.

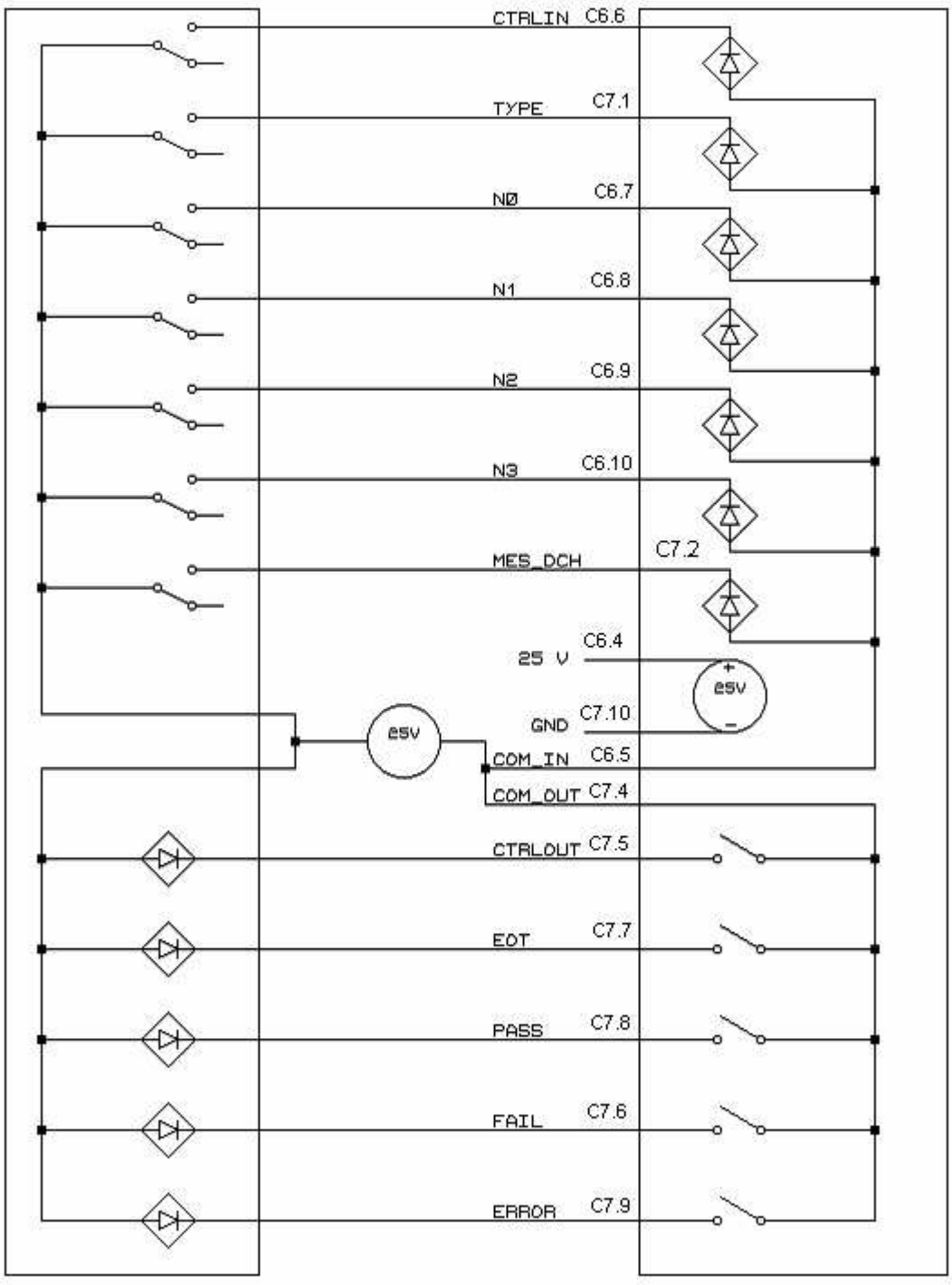


Diagram n°4 : PLC connection with external 25VDC power supply.

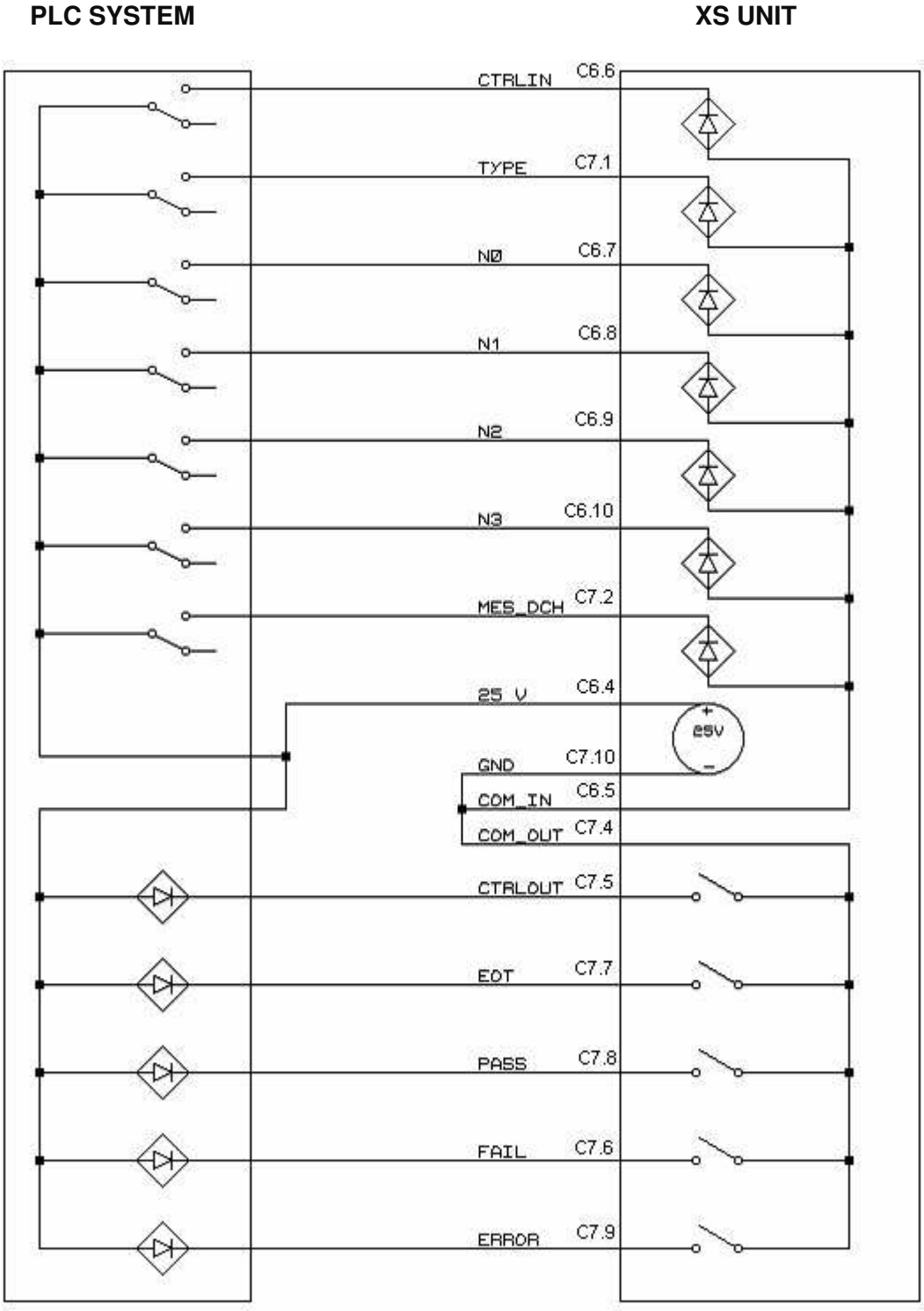


Diagram n°5 : PLC connection with internal 25VDC power supply.

0 -10 Volts analog input output (03 OPTION)

This option allows the unit to deliver a proportional analog voltage to the displayed measurements on the LCD screen (insulation resistance, test voltages, leakage currents) and allows controlling the dielectric strength test high voltage by an analog voltage between 0 and 10 volts. Jumpers for the setup of the board allow selecting different features.

Specification

- **Output voltage** : from 0 to 10 VDC by 2.44 mV steps
- **Input voltage** : from 0 to 10 VDC
- **Output impedance** : 1 kohm ±5%
- **Input impedance** : 10 kohms ±5%
- **Insulation** : Not insulated, the ground is earthed
- **Connection** : screw terminal connector C6 on the rear panel

1	0-10 volts input or output
2	0-10 volts output
3	Ground

Board setup according to the unit models

The board includes some jumpers described on the schematic underneath. These jumpers allow setup the board in a 2 analog outputs mode or in a 1 analog output + 1 analog input mode

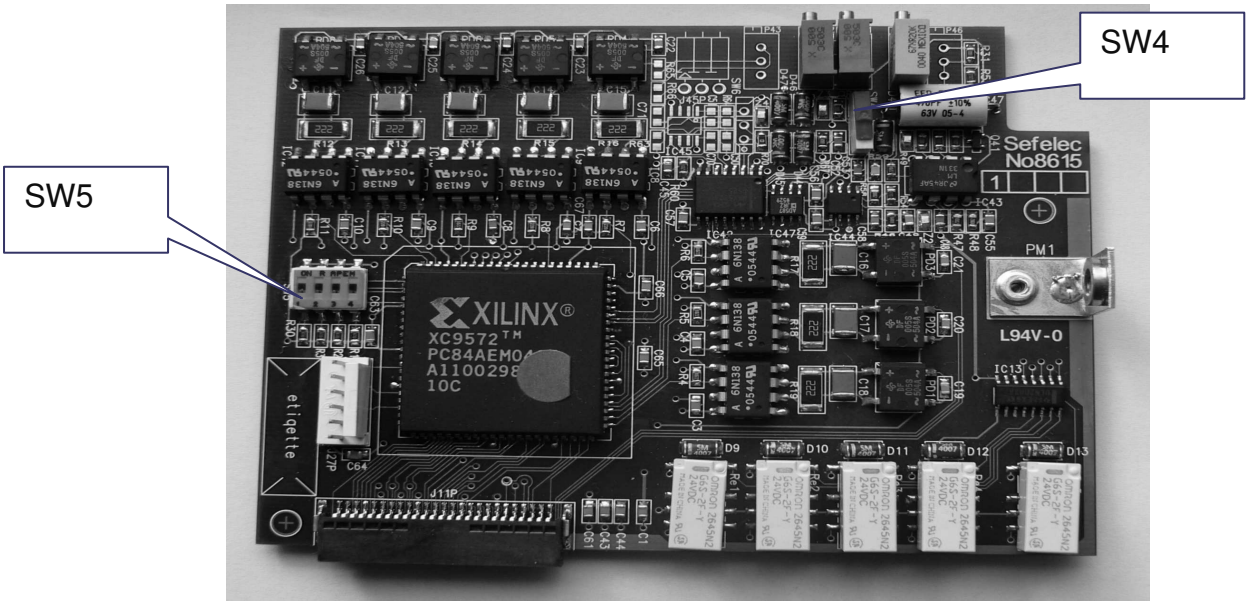
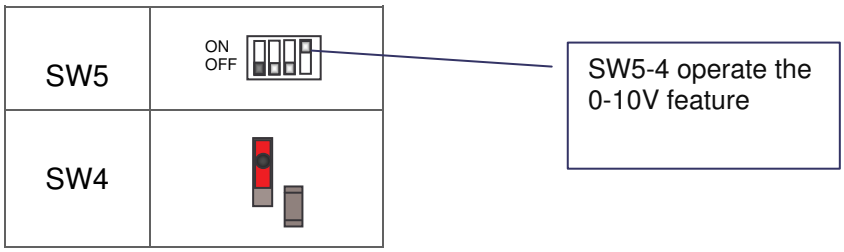


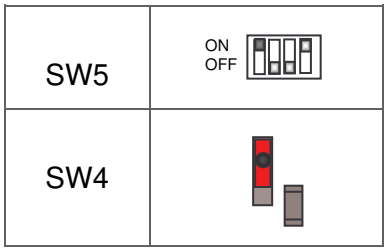
fig 12.2

configurations

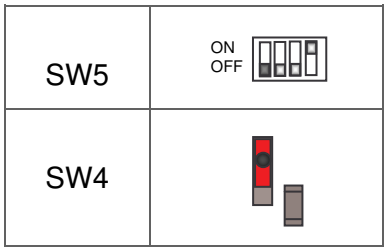
MEGOHMMETER : 1 output for the linear value of the resistance in a range
1 output for the value of the range



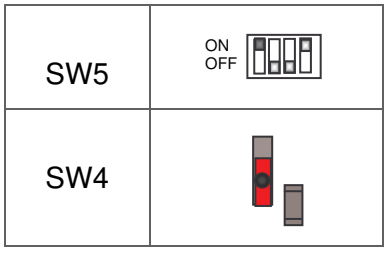
MEGOHMMETER 1 output for the logarithmic value of the resistance
1 output not used



DIELECTRIC STRENGTH TEST : 1 output for the high voltage value
1 output for the leakage current



DIELECTRIC STRENGTH TEST : 1 output for the high voltage value
1 input for the high voltage



Change of the board setup

IMPORTANT: the change of the board setup must be performed by skill people.

How to proceed:

- ✓ Remove the power cord
- ✓ Remove the screws securing the dark blue cover
- ✓ Push the dark blue cover backward to access to the boards (remove the earth wire if necessary)
- ✓ Unscrew the board locking nut
- ✓ Pull the board out
- ✓ Set the jumpers as described here above
- ✓ Plug the board
- ✓ Lock the nut
- ✓ Put the cover in its original position (with the earth connection)
- ✓ Screw the cover
- ✓ Connect the power cord
- ✓ Put the power on

Operation

Go in the [SETUP] menu
Go in <page 2>
On the INTERFACE line, select the PLC mode (Programmable Logic Controller)

If the **[MISSING OPTION]** message is displayed, please check that the board has been correctly installed.

Important
if the PLC mode is not selected, the Analog input-output function will not operate.

Megohmmeter mode, 2 outputs setup

Refer to section related to the board jumpers setup. This setup is the factory default setup.
The pin 2 of the rear panel connector C6 gives the value of the resistance in a range (V1).
The pin 1 of the rear connector C6 gives the value of the range (V2).

V1= value in a range, from 0 to 10 volts compared to the displayed value

V2= value of the range :

00.00	kΩ	=	0 volt
000.0	kΩ	=	1 volt
0.000	MΩ	=	2 volts
00.00	MΩ	=	3 volts
000.0	MΩ	=	4 volts
0.000	GΩ	=	5 volts
00.00	GΩ	=	6 volts
000.0	GΩ	=	7 volts
0.000	TΩ	=	8 volts

The resistor value is given by the following formula :

$$\mathbf{R = 2 \times V1 \times 10^{V2} \text{ kohms}}$$

For example : if V1=5.2 V and V2=3.0 V then R=10.4 Mohms

Accuracy of the 0-10 volts output voltage compared to the display :

±(0.1% + 5 mV)

Megohmmeter mode, 1 output setup

Refer to section related to the board jumpers setup.
The pin 2 of the rear panel connector isn't used
The pin 1 of the rear connector gives the logarithmic value of the measured resistor (V1)

The resistor value is given by the following formula :

$$\mathbf{R = 2 \times 10^{V1} \text{ kohms}}$$

For example: if V1=3.7V then R=10.0 Mohms

Accuracy of the 0-10 volts output voltage compared to the display : ±(0.1% + 5 mV)

Accuracy of the resistance computed with the output voltage : ±1%

Dielectric strength test mode, 2 outputs setup

Refer to section related to the board jumpers setup. This setup is the factory default setup.
The pin 2 of the rear panel connector gives the value of the measured high voltage (V1) :

- from 0 to 10 volts for 0 to 5000 VAC
- from 0 to 10 volts for 0 to 6000 VDC

The pin 1 of the rear connector gives the value of the leakage current (V2) :

- from 0 to 10 for 0.00mA to 9.99 mA

Test voltages and leakage current are given by the following formulas:

HTVAC = (V1/10) x 5000 volts
HTVDC = (V1/10) x 6000 volts
I = (V2/10) x Imax.
Imax = 9.99mA for SXS, DXS and RXS50
Imax = 99.9mA for SXS, DXS and RXS500

Accuracy of the 0-10 volts output voltage compared to the display : ±(0.1% + 5 mV)

Dielectric strength test mode, 1 output + 1 input setup

Refer to section related to the board jumpers setup.
This setup is operating only in the MANUAL mode

- Select HIPOT function
- Select PARAM
- On <page2>, on the line TIMER : select the MANUAL mode

The pin 2 of the rear panel connector gives the value of the measured high voltage (V1) :

- from 0 to 10 volts for 0 to 5000 VAC
- from 0 to 10 volts for 0 to 6000 VDC

Test voltages are given by the following formulas:

HTVAC = (V1/10) x 5000 volts
HTVDC = (V1/10) x 6000 volts

Accuracy of the 0-10 volts output voltage compared to the display : ±(0.1% + 5 mV)

The pin 1 of the rear panel connector is an input which can receive voltages between 0 and 10 VDC for output high voltages from 0 to the maximum value displayed on the parameter line:

VOLTAGE:x.xx VAC.

If the input voltage is higher than 10 V +5%, the following message is displayed :

[LIMIT ERROR]

Accuracy of the output high voltage compared to the input voltage :
±(1% + 20 volts) for a leakage current < 100uA
There is no automatic adjustment of the output voltage according to the load.

High voltage output response time for an input voltage variation :

- with display mode : < 1 second
- without display mode : < 0.5 second

Operating instructions

Use a shielding cable for the analog input and output lines.
Connect the shielding to the pin 3 of the C6 connector.

IEEE-488 interface

IMPORTANT
The IEEE-488 function must be selected in the SETUP menu page 2 on the line
INTERFACE : IEEE = 05

The test units of the XS series could be equipped with a IEEE-488 interface. This option makes possible the integration of any unit of the series in an automatic measurement or test system in manufacturing or incoming inspection department.

This interface is accessible through a connector provided on the rear panel.

Syntax rules

The end of a message must be the LF character (hexadecimal 0A, decimal 10).
The separators inside a message are ; or :
The commands can be sent either in small letters or in capital letters.
The maximum number of commands by message is 15.

NOTE :be careful not to put together standardised commands with other ones.

When a event like *transmission error,end of test, safety loop open*, ...,occurs during the measurement , the controller could be informed by a SRQ.
To activate this function, you must send a SRQ command just after the initialization of the unit.
On event, you could read the internal registers of the IEEE controler (STB,SRE,...) to get more precise reasons why.

If the message is not recognized by the unit, the error message <DIALOG ERROR : 1> is displayed

If the code is out of context, the error message <DIALOG ERROR: 2> is displayed
(special code for a function when the function was not selected or numerical value out of range)

IEEE-488-1 Fonctions availables

SH1,AH1,T6,L4,SR1,RL1,PP0,DC1,DT0,C0

List of the IEEE-488 commands

The syntax of the commands complies with the IEEE488-2 standard (1992 revision).
IEEE488-2 numerical formats :

Format NR1 : ±<digit>...<digit>
Format NR2 : +/-<digit>...<digit>.<digit>...<digit>
Format NR3 : ±<digit>...<digit>.<digit>...<digit>E+/-<digit>..<digit>
Note : Codes in brackets are expensed codes which can be understood by the unit

Commands

The command set for the IEEE-488 interface is the same as the RS232. It is described with a lot of details in the next subject RS232 interface.

RS232C interface

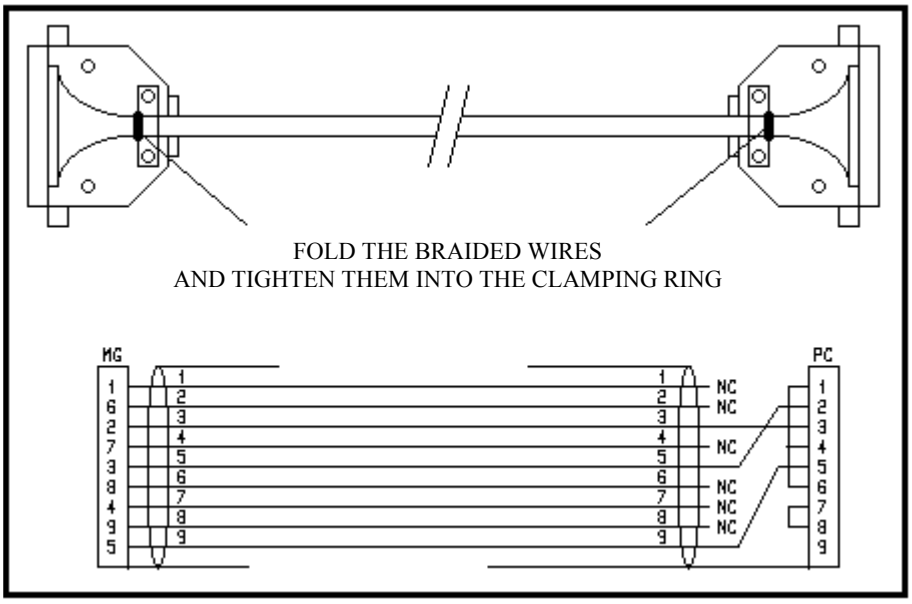
IMPORTANT
The RS232 function must be selected in the SETUP menu page 2 on the line
INTERFACE : RS232

The test units of the XS series are equipped with a RS232C interface operating in talker and listener modes. This option makes possible the integration of any unit of the series in an automatic measurement or test system in manufacturing or incoming inspection department.

A 9 pins connector is provided on the rear panel for the interface connection. The RS232C standard defines electrical specifications for the transmission of serial information. The use of the RS232C port requires five lines:

- Receive data **(RXD)**
- Transmit data **(TXD)**
- Data terminal ready **(DTR)**
- Data set ready **(DSR)**
- Signal ground **(GND)**

This interface also requires a cable type CO179. Refer below for the cable wiring



The communication parameters cannot be changed and are :

- Speed : 19200 bauds
- Parity : no
- Format : 8 bits
- Stop bit : 1

Syntax rules

The end of a message must be the LF character (hexadecimal 0A, decimal 10).
The separators inside a message are ; or :
The commands can be sent either in small letters or in capital letters.
The maximum number of characters in the message is 100 or 8 different commands

The end of the execution of a complete message by the unit is indicated by the emission of the Xon (hexadecimal 11, decimal 17) character and allows synchronizing the communication with the computer. The computer must wait the Xon character before sending the next message.

The events occurring during the measurement are indicated to the computer by the emission of the Z character (format error, end of test, interlock open, ...). To activate this function, it is necessary to send the SRQ command after the initialization of the unit. When receiving this character, a special command allows the computer to get the event (commands *STB?, *ESR?)

If the message is not recognized by the unit, the error message <DIALOG ERROR : 1> is displayed

If the code is out of context, the error message <DIALOG ERROR: 2> is displayed
(special code for a function when the function was not selected or numerical value out of range)

List of the RS232C commands

The syntax of the commands complies with the IEEE488-2 standard (1992 revision).
IEEE488-2 numerical formats :

Format NR1 : ±<digit>...<digit>
Format NR2 : +/-<digit>...<digit>.<digit>...<digit>
Format NR3 : ±<digit>...<digit>.<digit>...<digit>E+/-<digit>..<digit>
Note : Codes in brackets are expensed codes which can be understood by the unit

General commands

REM(REMote):
Go to remote mode.
WARNING : first command to be sent
For security reasons, this command is active only just after power on (starting screen displayed).

GTL(GoToLocal):
Go back to the local mode.

LLO(LLockOut):
Return to the local mode is locked

Common commands

***SRE <NR1> :** *"Service Request Enable Register".*
Enables the corresponding summary messages (bits) in the status byte register. Thus, the application programmer can select reasons for the device to issue a service request (Z character). See *STB? code.

***ESE <NR1> :** *"Standard Event Enable Status".*
Select which event bits in the corresponding Event register will cause a TRUE summary message when set. By use of the enable bits the programmer can program the device to request for a single event or an inclusive OR of any group of events.

***CLS :**
Sets all the standard registers in the state the programmer founds them after a power on.

***RST :**
The Clear status command almost resets the apparatus as a power on.
WARNING : the unit goes back to Local mode, send a REM command before any following commands.

Common queries

***STB? :**

return in hexadecimal format a <NR1> which is the value of "STB". (i.e. : "#H80")

b0	0 = Interlock opened 1 = Interlock closed
b1	0 = No error 1 = Error (voltage not correct,.....)
b2	0 = End of test 1 = Test running
b3	0 = Test fail 1 = Test pass
b4	Not used
b5	Logical OR of the ESR register bits
b6	Logical OR of the STB register bits
b7	Not used

***SRE? :**

return in hexadecimal format a <NR1> which is the value of "SRE". (STB register mask)

***ESR? :**

return in hexadecimal format a <NR1> which is the value of "ESR".

b0 à b3	Not used
b4	1 = Dialog error type 2 (Numerical value out of range, out of context command)
b5	1 = Dialog error type 1 (incorrect command)
b6	Not used
b7	1 = power on

*NOTE : the bits are reset after the reading of the byte by the *ESR? command*

***ESE? :**

return in hexadecimal format a <NR1> which is the value of "ESE". (ESR register mask)

***LRN? :**

This device query allows the programmer to receive a response message unit that informs the programmer on the current device state (function's running and current test parameters) and may be later used as program message unit elements to place the device in the state it was.

***IDN? :**

Allows the identification of the unit. The message is as follows:
<field1>,<field2>,<field3>,<field4>
field1 : Manufacturer name = Sefelec
field2 : Unit reference = CMG30, DMG50, DMG500, RMG50, MMG500, SMG50...
field3 : Serial number = 0 (not used)
field4 : Software revision = VERSION 1.60

*NOTE : the *IDN? command must be used before selecting a function (from the start display)*

***TST? :**

Allows to check that the unit is correctly working.
The message is as follows : #H<NR1> with:

	b3	b2	b1	b0	result
Hipot missing	X	X	X	1	#H01
Megohm missing	X	X	1	X	#H02
Continuity missing	X	1	X	X	#H04
Leakage missing	1	X	X	X	#H08

With X = 0 or 1

*NOTE : the *TST? command must be used before selecting a function (from the start display)*

Device commands

MEG(MEGohmmeter) :

Selects the megohmmeter. Must be sent from the initialization display.

HIP(HIPot) :

Selects the hipot tester. Must be sent from the initialization display.

LEAK(**LEAKage**) :

Selecs the leakage function. Must be sent from the initialization display.

GND(GrouND) :

Selects ground continuity function. Must be sent from the initialization display.

SEQ(SEQuence) :

Selects the sequence function. Must be sent from the initialization display.

CONF(CONFig) :

Selects the configuration function of the unit. Must be sent from the initialization display.

PAR(PARameter) <NR1> :

Selects the parameter set for the running function.
For instance : MEG : PAR 1

DCV(DCVoltage) <NR1> :

Sets a new value in volt to the current DC voltage parameter to the parameter set of the running function.
For instance : DCV 500

ACV(ACVoltage) <NR1> :

Sets a new value in volt to the current AC voltage parameter to the parameter set of the running function.
Hipot tester : Min. : 10 Max. : 5000
Leakage : Min. : 200 Max. : 270
For instance : hipot : ACV 5000 leakage : ACV 244

ACC (ACCurrent) <NR3> :

Sets a new value in ampere to the AC current parameter to the parameter set of the ground continuity function.

OHM (OHMmeter) :

Sets the main thresholds unit (Ohm) and the ground continuity display function.
Caution : The action on this command will erase all previous recorded thresholds (Reset to zero).

VOLT (VOLTmeter) :

Sets the main thresholds unit (Volt) and the ground continuity display function.
Caution : The action on this command will erase all previous recorded thresholds (Reset to zero).

HTIM(HTIMe) <NR1> :

Sets a new value in second to the current hold time parameter to the parameter set of the running function. Minimum time for the leakage current function : 2 Seconds
For instance : HTIM 3

RTIM(RTIMe) <NR1> :

Sets a new value in second to the current rise time parameter to the parameter set of the running function
For instance : RTIM 10

FTIM(FTIMe) <NR1> :

Sets a new value to the current fall time parameter to the parameter set of the running function.
For instance : FTIM 5

HLIM(HLIMit) <NR3> :

Sets a new value to the high limit parameter to the parameter set of the running function.
For instance :
MEG:HLIM 2.0E+6 (new value in Ohms)
RIG:HLIM 1.45E-4 (new value in Amps)
GND:HLIM 1.00E-1 (new value in milliohm)
The unity is automatic, given in Volt, Ohm or Amp and function dependent.

CBHLIM <NR3> :

Same command as HLIM, but reset the low limit parameter before to change the high limit value.

LLIM(LLIMit) <NR3> :

Sets a new value to the low limit parameter to the parameter set of the running function.
For instance :
MEG:LLIM 1.0E+6 (new value in Ohms)
RIG:LLIM 3.50E-6 (new value in Amps)
GND:LLIM 5.02E-2 (new value in milliohm)
The unity is automatic, given in Volt, Ohm or Amp and function dependent.

(Aa, Bb, Cc, Dd, Ee, Ff, Gg, Hh) :

Parameters setting a sequence of 8 tests of the selected memory only for SXS models. Each test is defined by 2 letters : one for the function (M for megohmmeter, H (HIPOT) for strength, G (GROUND) for earth continuity, X(points=) for test number in case of multiple earth continuity test, P(Pause) to place a waiting phase between two consecutive tests and L (LEAKAGE) for leakage current), and one digit to indicate the memory number (cases M, H, G, L, V). V0 is an empty test. The case X is special, because it can be followed by one or 2 digits. These one indicate the step number of the multiple continuity. This number can be set from 2 to 99.
Caution : All 8 tests must be carried out (Enter V0 for an empty test).
For instance : SEQ : PAR 0 : (G1,M2,H1,M3,L1,V0,V0,V0)

BEEP ON/OFF

This command is attached to the configuration function and controls the beep signal when the measurement result is false.
It is not possible to stop the beep signal completely.
For instance : CONF:DISP OFF

DISP(DISPlay) ON/OFF

This command is attached to the configuration function and controls the display mode.
For instance : CONF:DISP OFF

[expert]

EXP(EXPert) ON / OFF

Set the EXPERT mode ON or OFF

MOD (MODe) AUT/MAN

This command is attached to the setup function. It switches the mode AUTO and MANUAL of the sequence function (only with the family units of SMG and FMG).

SBS (Step By Step) ON/OFF

This command takes part of sequence function of the SMG and FMG.
It fixes on the way of the test results are send back to the controller (RS232, IEEE).
In ON mode, the result of every steps of test is transmitted as soon as available, without any request before (no MEAS?).
In OFF mode, all the results are transmitted together at the end of the sequence in answer to the command MEAS?
IMPORTANT : After power on the mode SBS is automatically set with OFF value.

TIM(TIMe) AUT/FAIL/UDIV2

Select the temporization mode. AUT for automatic, FAIL for default and UDIV2 for U divided by 2.
The UDIV2 mode concerns the hipot function.
The FAIL mode concerns the ground continuity function and the hipot 500VA function only.

FILT(FILTer) NOR/CAP/RHT

Enables the normal or the capacitor or the Real Hold Time measurement modes.
For instance : CONF:FILT CAP

DET(DETection) OFF / I / FI / I+DELTA / FI+DELTA / DELTA :

Hipot function only sets the mode of the breakdown.

IDE(IDElta) <NR3>

Hipot function : Delta I breakdown detection value adjustment

[expert]

RDET(RDETection) OFF/ I / I+DELTA / DELTA / FI / FI+DELTA

Hipot function: Selection of the breakdown detection mode during the high voltage rise and fall times.

[expert]

IMRA <NR3>

Hipot function:setting of the break detection value IMAX or FIMAX during the high voltage rise and fall times.

[expert]

IDERA <NR3>

Hipot function:setting of the break detection value of Delta I during the high voltage rise and fall times.

[expert]

UDISP ON/OFF

Hipot function: Display control of the value of high voltage during the high voltage rise and fall times.

[expert]

IDISP ON/OFF

Hipot function: Display control of the value of the current during the high voltage rise and fall times.

MEAS(MEASure)

Runs the current function.

STOP

Stops the current function.

QUIT

Exits the current function.

SRQ

Similar to the Service Request feature of the IEEE488-2 bus, this code allows the emission of the **Z** character to inform the computer about the events (end of test, format error, interlock open,...). This command has to be sent at the program start, after the REM command.

Device queries

MEAS?

Return the current measurement value(s) regarding the running function.

A) Following characters in the function
Insulation : OHM 4.700E+06
Dielectric strength : VOLT 9.900E+02 AMP 7.000E-05
Continuity : OHM 3.210E-1 VOLT 2.810E+00 (main unit =OHM)
Continuity : VOLT 2.830E+00 OHM 3.230E-1 (main unit =VOLT)
B) Following characters in sequence mode
For instance :
L1 C0: 0.15mΩ 0.00V,L2 R0: 1.50KV 0.02mA,L3 M0: 41.7 GΩ,L4 F0:q 0.01mA 223V A2,L5 ..: ,L6 ..: ,L7 ..: ,L8 ..:

The syntax rules are the following :

- the end of the message is : CR (Carriage Return)
- each test step starts with a « **L** » and ends with « **,** » (except for the last one) .

- the « **L** » letter is followed by a number between 1 and 8 , giving the test step number and then by a « **space** ».
- then comes a letter according to the type of the test step :

Function	French	English	German
Insulation	M	M	M
Dielectric strength	R	H	H
Continuity	C	G	E
Void	. .	. .	. .
Pause	OK.	OK.	OK

- the measurement type is followed by the memory number which contains the measurement parameters , then by a separator character « **:** »
- if the test step is void , the measurement will be replaced by a « **space** »
- otherwise , the next character gives the test step result :
  - « **space** » indicates that the test is good
  - « **q** » indicates that the test is bad
- for the insulation and dielectric strength tests the previous character is followed by 1 'space' and for the ground continuity test by 2 'space'.
- then the numerical values are given . When the value cannot be measured (no continuity or overload) the numerical indication is replaced by « **----** »

To check if a tested specimen is good or bad at the end of a sequence , it is necessary to check the STB register (bit 3) .To get the result of each test step , check if the result character is « **space** » or « **q** ».

RS232 / IEEE-488 commands summary

Code	Init menu	setup	mΩ	kV	MΩ	Seq.
REM	X					
*CLS	X	X	X	X	X	X
*ESE	X	X	X	X	X	X
*ESE?	X	X	X	X	X	X
*ESR?	X	X	X	X	X	X
*IDN?	X	X	X	X	X	X
*LRN?			X	X	X	
*RST	X	X	X	X	X	X
*SRE	X	X	X	X	X	X
*SRE?	X	X	X	X	X	X
*STB?	X	X	X	X	X	X
*TST?	X					
GTL	X	X	X	X	X	X
LLO	X	X	X	X	X	X
ACC			X			
ACV				X		
CONF	X	X				
DCV				X	X	

DET				X		
IDE				X		
RDET				X		
IMRA				X		
IDRA				X		
UDISP				X		
IDISP				X		
MOD		X				
SBS						X

code	Init menu	setup	mΩ	kV	MΩ	Seq.
BEEP		X				
DISP		X				
EXP		X				
FILT		X				
FTIM			X	X	X	
GND	X		X			
HIP	X			X		
HLIM			X	X	X	
CBHLIM			X	X	X	
HTIM			X	X	X	
LLIM			X	X	X	
MEAS			X	X	X	X
MEAS?			X	X	X	X
MEG	X				X	
OHM			X			
PAR			X	X	X	X
QUIT	X	X	X	X	X	X
RTIM			X	X	X	
SEQ	X					X
SRQ	X	X	X	X	X	X
STOP			X	X	X	X
TIM			X	X		
VOLT			X			

Advices and programming exemples

In order to help you writing control software for the XS series, we provide a training software XSCom.

The XSCom software gives you the possibility to fully control all the unit functions in following step by step all the detail exchanges between the PC and the measurement device.

This training software has been written in three languages: Delphi (pascal) , C++ Builder (C++) and Visual basic.
Source codes are provided with many comments.

For more detail, refer to the XSCom files on the CD.

Trouble shooting the RS232 interface

When the RS232C interface is not operating as described in this manual, please check the following points:

No reaction from the XS unit when sending commands :

- The cable between the XS unit and the PC computer must be correctly connected at both ends. The cable is a special wiring cable : check that the cable is a Sefelec CO179 model or check that the wiring has been done according to the instructions .
- The XS series units have several possible interface types : check that in the SETUP menu <page2>, the RS232 mode has been selected on the INTERFACE line.
- The end of message must be the LF (hexa 0A,decimal 10) character. If this character is not sent, the XS unit won't handle the message : check that this character is added to the command.
- The first command must be the REM command, which displays the REMLOC message on the LCD display, the unit being ready to receive all the others commands.
- WARNING : the first REM command should not wait for the Xon character before being sent.

The unit goes in REMOTE mode and then hang up :

Before sending a new command, it is mandatory to wait that the XS unit indicates its non busy state by sending the Xon character (hexa 11,decimal 17). If a code arrives during the handle of the previous one, it can produce an erratic operating mode of the unit or stop it.

13 APPLICATION NOTES

WHY DIELECTRIC TESTS ?

The dielectric tests are performed in order :

- to detect manufacturing fault on electrical equipment
- to verify the quality of the insulating material of an electrical equipment
- to verify that an electrical installation has been correctly done
- to control the insulation resistance of an equipment or an installation to trace its changes during the years.

Dielectric tests consist of both insulation resistance measurements and dielectric strength tests.

GLOSSARY OF TERMS

- **LEAKAGE DISTANCE :** The smallest required distance, measured on the surface of the insulating material, between 2 conductive parts, to avoid breakdown.

- **LEAKAGE CURRENT :** Steady current flowing through an insulating material subject to high voltage.

- **BREAKDOWN :** The immediate break of the dielectric property of an insulating material. Every breakdown creates more or less damages to the insulating material. The breakdown tests can be therefore destructive or not.

- **INSULATION RESISTANCE :** Characteristic of an insulating material that being subject to a voltage, shows a resistance such as the value of the leakage current which flows through it stays within acceptable limits.

- **DIELECTRIC STRENGTH :** Ratio between the voltage at which a dielectric break of the insulating material occurs and the distance between the two points subject to the voltage (generally given in kV/cm). Regarding the insulating material type (solid, liquid or gas) a dielectric break can be : a perforation, a flashover or an arc.

ENVIRONMENTAL INFLUENCES

Temperature, pressure and humidity conditions have an influence on the dielectric tests results.

- **TEMPERATURE :** The temperature having an influence on the gas density, this one is altering the performances of the liquid or gaseous insulating material. The oils, often used as insulation are never pure, the dissolved quantity of gas increases with the temperature and is decreasing the insulation quality of the oil. The large variety of materials used as solid insulation doesn't allow to deduce a general rule on their behavior with the temperature (the insulation specifications having a tendency to dissipate when the temperature increases).

- **PRESSURE :** The withstand voltage in gas changes with the pressure following the Paschen's law. This law shows a minimum of the breakdown voltage for a particular value of the pressure by distance product, otherwise the more the pressure increases, the more the breakdown voltage is high. The liquids used as dielectric insulation are influenced by the pressure, the dielectric strength increasing with the pressure. In theory, the solid insulations are a little influenced by the pressure because this one doesn't modify a lot their thickness and their internal composition.

- **HUMIDITY :** The withstand voltage of gas changes with humidity. In example for the air and for values of relative humidity < 80%,the dielectric strength increases a little with the humidity increasing (the water molecules, more dense than the gas, slows down the avalanche phenomena). The water presence in an insulating liquid such as oil degrades the dielectric strength by water electrolysis, development of gas producing partial discharges bringing to breakdown. Under combined effect of the humidity (>95%) and the temperature (>100°C) most of the polymers dissipate. The water can produce inflating in the insulation and create cracks which will facilitate the electric arcs advance.

INSULATION RESISTANCE MEASUREMENT

The insulation resistance measurement is intended to verify that the various components and sub-assemblies of electrical equipment have an insulation resistance such as the leakage currents don't reached inadmissible values.

The principle is to apply a DC voltage, stable and specified (selected among the standard values) between defined points and after a prescribed time, to measure the current flowing through the tested material. By using the Ohm's law (resistance = voltage / current), the result is given by the value of the insulation resistance. Then this value is compared to the minimum threshold specified by the standard used for the test.

PRECAUTIONS TO BE OBSERVED

It is important to connect the specimen to be measured in taking care of the parasite leakages which could be created by the measurement operating procedure.

The supplied accessories have a shielding which is connected to a guard potential, this insures a good immunity of the measurement regarding the parasitic leakage currents and the AC residuals.

When using extending of the basic probes, take the necessary cares to avoid to introduce measurement errors (short leads, leads not touching any metallic or insulating parts,....)

During insulation resistance measurements having high values (> 100 Gohms), the proximity of the operator putting his hand close to the specimen under test, can alter or make unstable the measurement. It is important to beware of Nylon blouses or of insulating material things capable of generating by static electricity, high electrical fields which can alter the measurement of high value resistances (100 Gohms under 100 VDC = 1 nA of measurement current).

MEASUREMENTS OF CAPACITORS

We remind that a lot of recent electrical units are fitted with main line filters including capacitors for the electromagnetic compatibility. When measuring on capacitors it is advised to select the filter mode **CAPACITOR** of the SETUP menu in order to stabilize the measured values.

A) Indeed, on capacitors, the variations of the measurement power supply, even small as well as the interferences are entirely transmitted to the input of the current measurement system which have a very high gain, and therefore will amplify these variations. The **CAPACITOR** filter switches on circuits which will limit the instability of the measurement.

B) Never perform insulation resistance measurements on capacitive specimens in reducing the measurement voltage between each test, but always in increasing the voltage. The hysteresis and polarization phenomena of the dielectric material will alter the results. In that case the unit indicates its maximum value and takes a long time to come back to the real measured value.

C) The insulation resistance value of a capacitor being a function following a time exponential law, it is important to make sense to the measured value, to indicate the duration of the measurement. The units of the MG series allow complying with this requirement with the built-in timer, able to measure times going from 1 second up to 16 minutes.

D) Never disconnect a capacitive specimen before switching into DISCHARGE mode and waiting the necessary time to discharge its capacitance through the 2.2 kohms built-in resistance of the discharge circuit (about 1 second per 100 uF).

MEASUREMENTS ON CABLES

The measurement on cables is similar to the measurement on capacitors

The measurement configurations on cables are very varied. The measurements have to be performed either between each conductor for multi-wires cables, either between main conductor and shielding for shielded cables, either between the cable and its environment for mono-wire cables.

A) In that last case, the generally used way is to immerse the cable reel in a water tank (called SWIMMING POOL), to wait for the water penetration in to the cable reel center, and then to perform the insulation resistance between the cable and the water. For safety and construction reasons the water tank is grounded. The insulation resistance measurement unit must be able to measure a specimen with one grounded end. The units of the MG series allow performing easily this type of measurement, because the hot point of the high voltage generator is already grounded. You just have to connect the measurement input of the unit (with the HV probe) on the cable to be measured and to trigger the measurement.

B) Another specific point, when measuring on cables, is that the specifications of the cable manufacturers give resistance values for a standard length of cable equal to 1 km (1000 meters).
When testing the reels of cable, those are never equal to the standard length, that forces the operators to calculate the resistance as a function of the cable length and the number of wires in parallel for the multi-wires cables. Consequently the built-in comparators of the measurement units can not be used, because they compare regarding to the total insulation value and not regarding the standard value. The units of the MG series allow with the option 23 to display insulation resistance measurements reduced to 1 km and 1 wire, and therefore allow the use of the built-in comparators. The operator can enter in a specific menu of the unit the length of the cable under test as well as the number of wires. The result is given in Mohm per km.

i.e. : the unit measures a value of 10 Mohms for a 10 km long mono-wire cable. Therefore, the value reduced to 1 km will be :

(Rtotale / 1 km) x Length = 100 Mohm.km

For the same cable with 10 wires, the value for 1 wire will be :

100 Mohm.km x 10 = 1000 Mohm.km

C) The insulation resistance value of a cable being a function following a time exponential law, it is important to make sense to the measured value, to indicate the duration of the measurement. The units of the MG series allow complying with this requirement with the built-in timer, able to measure times going from 1 second up to 16 minutes.

MEASUREMENT VOLTAGE SELECTION

The insulation resistance measurements intending to verify that materials or equipments comply with standard requirements, it is important to refer to these standards to select the voltage. The standard voltages are generally : 50, 100, 250, 500 VDC.

In case of no standard, select a 100 VDC value.

When measuring on capacitive specimens and when studying the voltage influence on the insulation resistance values, it is important to start always with the lowest voltage and then to follow the measurements in increasing the voltage. A procedure in the reverse way could give incoherent results.

DIELECTRIC STRENGTH TESTS

The dielectric strength test is intended to stress components and sub-assemblies of electrical equipments and to check that the leakage lines either between points or between points and ground are correctly designed according to the used technology.
The principle of a dielectric strength test is to apply a voltage (DC or AC) between defined points and after voltage stabilization, to check that the leakage current, created by breakdown phenomena or breakdown discharges (in the air or in the insulating materials), is not greater than the nominal acceptable value.
The default sanction is determined by the analyze of the shape, the amplitude and the holding time of the current supplied by the generator to the specimen under test and by comparison with a preset limit.

SELECTION OF THE TEST VOLTAGE

The dielectric strength tests intending to verify that materials or equipments comply with standard requirements, it is important to refer to these standards to select the voltage.
In case of no indication regarding the test voltage, a common rule is to apply the following formula :

Utest = 2 x Unominal + 1000 volts

Most of the standards specify the type of the test voltage : AC (50-60Hz) or DC. A common rule is to test the specimen with a test voltage of the same type that the voltage which will be apply during the final use. However, certain among of technical difficulties exist which force to depart from this common rule.

DIELECTRIC STRENGTH TESTS WITH AN AC VOLTAGE

BENEFITS :

- The specimen is stressed with the both voltage polarities.
- The specimen being not charged, there is no need for a discharge system

DISADVANTAGES :

- Most of the tested specimens having a certain amount of capacitance, the HV source have to supply the leakage current as well as the reactive current, this involves an over-sized generator with an increase in prices, in weight and a decreasing of the operator safety who is exposed to higher currents.
  The reactive current can be evaluated with the following formula :
  Impedance = Voltage / Current (Ohm's law : Z=U/I)
  for capacitances : Z = 1 / Cw with w = 2*Pi*F
  reactive current : Ir = U*C*2*Pi*F
  i.e. U=3000 volts C=1nF (~ 10 meters of shielded cable)
  Ir=3000*1E-9*2*3.14*50=0.942 mA

- Require to adjust the permanent leakage current threshold (IMAX) regarding the capacitance of each specimen.
- When testing a specimen which will be used with a DC voltage, the AC voltage test can result in a decreasing of the life time because in particular of the heating and the CORONA effect. Under the effect of an electrical field, the orientation of molecules is done with friction which will occur with an AC voltage at each cycle (every 20 or 16 mS). Consequently the AC test is more severe than the DC voltage test.

DIELECTRIC STRENGTH TESTS WITH A DC VOLTAGE

BENEFITS:

- The power of the HV source can be lower than the one necessary in AC voltage (less weight and more safety for the operator). The current flows through the specimen only during the charging phase.

DISADVANTAGES:

- The charging current can trigger the breakdown detection
- The specimen being charged, it must be discharged through the built-in discharge resistance (1.5 Mohm).

WARNING: Wait enough for the discharge of the specimen capacitance before disconnection from the unit (about 8 seconds per uF).

- The specimen is tested in only 1 polarity
- The test voltage must be higher than the one provided with AC test voltage. A common rule is to use a 1.4 correction factor between the DC and the AC voltages (= square root of 2 = ratio between the rms value of a sinusoidal wave and its crest value) :

Udc = Uac * 1.4

BREAKDOWN DETECTION MODE SELECTION

The most common and simple leakage current control mode is the threshold current control mode or IMAX mode. This mode allows setting a maximum limit of current flowing through the specimen under test above which the unit detects a breakdown and stops the test by cutting off the HV generation and memorizing the voltage value on the LCD screen. As described, the HV source has to supply the leakage current as well as the reactive current coming from its capacitance. Therefore this requires to adjust the breakdown threshold regarding the reactive current of each specimen, and to follow the procedure :

- Make a test on a good specimen
- Collect the total current flowing
- Adjust the current threshold to a value greater than the total current.

The XS series units offer the above described detection mode, combined with the ∆-I detection mode (called sometimes ARC detection mode). The ∆-I mode allows to release from the reactive current flowing through the capacitive specimens.

To detect a breakdown, the ∆-I mode (ARC detection) monitors only the fast current variations (t>10uS and amplitude>1mA). This doesn't require any adjustment regarding the specimen capacitance. However this mode can not detect a dielectric strength default in case of a specimen in short-circuit since the high voltage application. That is why the MG series units allow to combine the IMAX and the ∆-I modes in order to make reliable and without adjustment of dielectric strength tests. The IMAX value is set to a value close to the unit short-circuit current under the test voltage.

The MG series units allow to inhibit the detection systems (OFF mode) in order to locate visually where is the dielectric strength fault. WARNING : this mode doesn't cut off the high voltage and therefore it is possible to destroy or burn the specimen under test. The power of the HV source being limited, a continued use of the OFF detection mode can trigger the built-in thermal safety switch. Under those circumstances (display of the message : INTERLOCK DISABLE) wait between 3 and 5 minutes before proceeding to the tests.

Ground continuity measurement

On a unit or an electrical device using or generating hazardous voltages, ground continuity measurements insure that all the accessible protective parts are correctly connected to the protective earth connection wire.

This measurement is almost a low resistance measurement except that it has to be performed with a high current, mostly in AC .

The principle is to flow a current between each metallic accessible parts and the protective earth connection, to measure the voltage drop between the 2 parts and to check with the Ohm's law that the equivalent resistance is lower than the standard required value.

Current selection

The measurement current is defined by the safety standards which have to be used for each product. According to the main standards, this high current is comprised between 10 and 25 A AC or equal to 2 times the nominal operating current of the device.
The choice is justified by the fact that the protective earth connections have to be able to flow the fault current for the maximum value of the unit operating current and this during the reaction time of the other protective devices (fuses, breakers, etc...)

Voltage selection

This is the open voltage of the current generator used for the measurement. This voltage, mostly given by each safety standards is mandatory a low value (lower than the threshold defining a hazardous voltage) but it must allow the measurement current flowing, taking care of the voltage drops between the generator and the measurement points.

The open voltages are comprised between 6 and 12 AC volts.

Test time

Unlike a simple resistance measurement, the time that the current is being flowing for the ground continuity measurement is important because of the 'Safety' function of the tested connection.
Beyond the ohm value evaluation, it is mandatory to test the quality of the connection to the earth potential (diameter of the wire, solders quality, screwing quality, ...). A manufacturing fault of one of these connections may in certain circumstances give an immediate correct ohm value, but increasing quickly by heating causes by the high current value used for the test : this high current can produce a break of the wire (wounded wire, which diameter becomes too small).

This is why some standards are requiring a minimum test time from 1 to 5 minutes for this measurement. Other standards don't give any time indication, but it is advised to apply for type test a minimum time of 1 minute and for series tests at least 10 seconds.

Precautions to be observed

The measured resistance values being very low (< 1 ohm), it is necessary to perform the measurement in using the 4 wire method to avoid the measurement lead parasitic resistance (interfaces, adapters , ...) It is necessary to warrant this measurement principle when connecting the measurement unit to the test points.

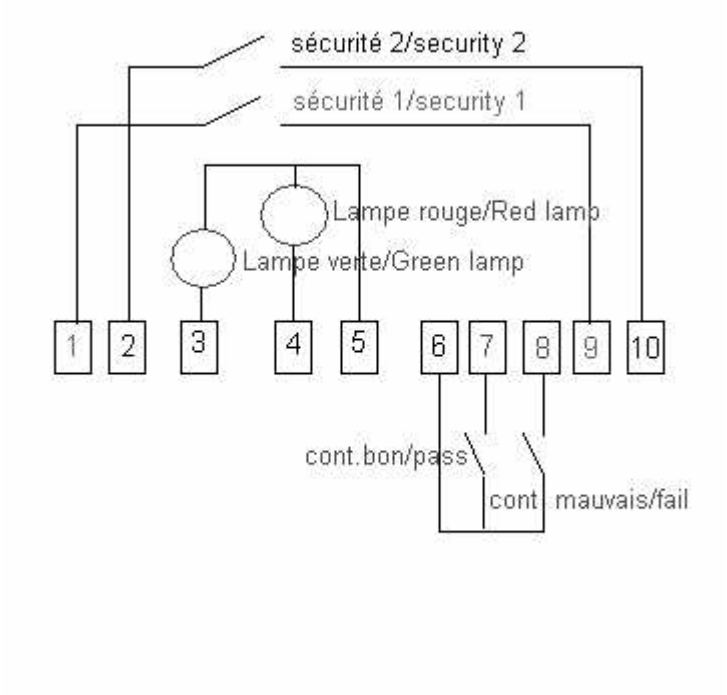
If specific connections have to be done, it is necessary to use correctly rated cables (at least 5A/mm^2) for the current and to connect voltage measurement cables as close as possible to the measured points.

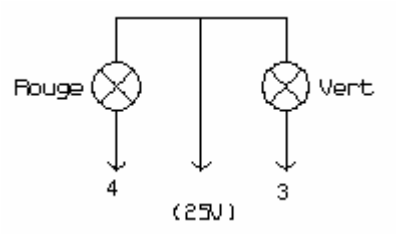
During the test time, it is advised not to move the probe to avoid breaking the current flowing which will produce sparks. This can modify the real total test time and can alter the contact surface of the specimen.

14 Safety interlock connector (C5)

1	Safety interlock contact : to be connected to pin 9
2	Safety interlock contact : to be connected to pin 10
3	Green lamp
4	Red lamp
5	25VDC common for green red lamps
6	0 Volt ground
7	PASS contact
8	FAIL contact
9	Safety interlock contact : to be connected to pin 1
10	Safety interlock contact : to be connected to pin 2

How to connect the green and red lamps, the security loop contacts, and the contacts pass/fail




Rouge
Vert
4
(25V)
3

15 Maintenance and calibration

PRELIMINARY

Our warranty (refer to the beginning of this manual) attests the quality of materials and workmanship in our products. If malfunction should be suspected or other information is desired call our technical assistance: (33) 1.64.11.83.48 for FRANCE or contact your local distributor.

INSTRUMENT RETURN

Before returning an instrument to our Service Department, please call them at the above phone number for shipment instructions. Use packaging that is adequate to protect it from damage.

MAINTENANCE

Our units don't need particular maintenance except an annual calibration. If problems, please follow the brief check list here after. If the problem continues, call our service department at the above number.

LCD SCREEN DOESN'T COME UP:

- Check the correct connection of the main cord SE1
- Check that the main voltage is in accordance with the value displayed on the main inlet on the rear panel of the unit
- Check the fuse in the main inlet on the rear panel

DISPLAY OF THE MESSAGE : INTERLOCK OPEN or SAFETY LOOP OPEN

- Check that the C5 connector has been correctly connected on the rear panel
- Check that the correct connection have been done on the C5 connector (1-9 and 2-10)
- If using an external contact to close the safety interlock, check that the contact works as expected.

The other possibilities for a bad functioning need an intervention inside the unit by qualified people. However we can supply a service manual including schematics of our units. Please get in contact with our Service department in order to know price and delivery time.

CLEANING

Only clean the instrument with a mild rag or slightly soaked with water.

CALIBRATION

We recommend calibrating our units each year. The calibration must be performed by qualified people having the complete procedure as well as correctly checked standards. Our Maintenance department is at your service to perform the annual calibration.

Nevertheless, if you wish to perform yourself the calibration, we can provide a calibration kit including a manual (XS90) and calibration boxes (XS-91-1, XS-91-2, XS-91-3, XS-91-4).

Please get in contact with our Maintenance department in order to know the price and the delivery time